pounded, processed and cured to assure correct processing performance.

6. Does Shell Isoprene Rubber require different compounding ingredients than natural rubber? No. Shell Isoprene Rubber can be used with the same plasticizers, reinforcing agents, softeners, accelerators, vulcanizing ingredients and coloring agents as natural rubber.

Slight modifications of some formulations may be required to obtain optimum properties.

7. Can Shell Isoprene Rubber be processed in conventional equipment? Yes. Its processing characteristics, compounding formulations and vulcanization techniques are all similar to those of natural rubber.

Shell Isoprene Rubber is also compatible with natural rubber and most synthetic polymers and can be blended with them in any proportion.

New Shell Isoprene Rubber requires less mastication than natural rubber and it can be chemically plasticized at a faster rate. If it is subjected to the same breakdown as natural rubber, Shell Isoprene Rubber will become too soft for practical use.

Caution should be exercised when chemical plasticizers are used. They have a more rapid action with new Shell Isoprene Rubber than with other elastomers.

8. How does Shell Isoprene Rubber handle on the mill? It can be handled on the mill without pre-breakdown. When a smooth rolling bank is attained, compounding ingredients can be added in the normal way.

9. How about mold flow? New Shell Isoprene Rubber is superior to natural rubber in mold flow. This allows for better and more complete fill in intricate molds, finer detailing and increased production as a result of fewer rejects.

10. What can you make with Shell Isoprene Rubber? Since its initial introduction for commercial evaluation, manufacturers have discovered that Shell Isoprene Rubber's high resiliency, low heat build-up, color, uniformity, purity, mold flow and ease of processing make it ideal for hundreds of applications. Here are just a few:

Heavy-duty truck tire treads, carcasses and sidewalls, automobile bushings, motor mounts, protective bumpers, windshield wipers, surgical tubing, intravenous feeding tube connectors, crutch tips, toys, rubber thread, swim fins, bathing caps, instrument bellows, telephone ear pieces, electrical connectors, wire and cable insulation, shoe heels and soles and rubber bands.

Its future applications are unlimited.

How to get Shell Isoprene Rubber

To order, call your nearest Shell Chemical sales office. They are located in New York, Cleveland, Ohio and Lakewood, California.

Shell Isoprene Rubber and many of the more popular SBR types are stocked at the eight Shell warehouses in the cities shown above.

11. Can you get technical assistance from Shell? Yes. In addition to Research and Control Laboratories, Shell Chemical maintains a complete Technical Service Laboratory at Torrance, California. Both laboratory and in-plant assistance are available.

12. How much Shell Isoprene Rubber will be made? Shell's newly enlarged facilities at Torrance can produce 40,000,000 pounds of Shell Isoprene Rubber a year.

A second Shell Chemical plant with an annual capacity of 80,000,000 pounds is now under construction at Marietta, Ohio. This new plant is expected to be on stream late in 1961.

13. How about availability? New Shell Isoprene Rubber is now available in carload lots from Torrance. Shell Chemical can fill your order immediately.

For less than carload lots, Shell Isoprene Rubber is available from eight Shell Chemical warehouses. Their locations are: Boston, Trenton, Baltimore, Lima, Nashville, Chicago, Portland, Oregon and Los Angeles.

14. Will Shell sell mixed loads of Shell Isoprene Rubber and SBR at carload prices? Yes. Mixed loads of Shell Isoprene Rubber and any of the SBR types on Shell's price list will be shipped from Torrance at applicable carload prices.

Shell Chemical also stocks many of the more popular SBR polymers at Eastern warehouses. These may be purchased to round out loads meeting minimum tariff weights required for truckload or carload prices.

15. Will Shell Isoprene Rubber completely replace natural rubber? Only in the event of a national emergency.

A U. S. Cabinet Member recently stated: "Commercial development of polyisoprene is an important aid to national defense. Its availability in sufficient quantities will free the United States completely from dependence on foreign sources of rubber in time of emergency."

16. Are samples and technical information available? Yes. Simply write or call your nearest Shell Chemical, Synthetic Rubber Division sales office.

They are: 110 West 51st Street, New York 20, N. Y., JU 6-5060; 1296 Union Commerce Building, Cleveland 14, Ohio, TO 1-8096 and 5230 Clark Street, Lakewood, California, SP 3-4997.

Samples of new Shell Isoprene Rubber and technical information are yours for the asking.

A bulletin from

Shell Chemical Company

SHELL

Synthetic Rubber Division

News about

B.F.Goodrich Chemical *raw materials*

HYCAR 4021

operates from 100° to 150° higher than most other rubbers

RESISTS SULFUR-BEARING OILS, TOO. This polyacrylic rubber provides unusually high oil resistance, remaining soft and flexible even in service with sulfur-bearing, extreme-pressure lubricants. Hycar 4021 operates at 350° to 400°F., far higher than most other rubbers can stand.

Its excellent physical properties and good high-temperature compression set make it ideal for hydraulic transmission seals, hose, automotive gaskets, and "O" rings. In addition, Hycar 4021 is often the logical choice for belting, tank linings, white or pastel colored goods and solvent coatings for industrial fabrics where high-temperature service is encountered.

You can get complete information on the advantages and compounding of Hycar 4021 in Bulletin HM-3. For a copy, or for information about any of the many Hycar rubbers and latices, write Department FA-11, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

See our catalog in Sweet's Product Design File.

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Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

DECEMBER, 1960 VOL. 88, NO. 3

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Highlights Sidelights *of the News . . .*

December, 1960

The 45th Annual Meeting of the Rubber Manufacturers Association, held on November 17th in New York City, attracted more than 200 rubber company executives . . . The meeting featured a review of the rubber supply-demand situation, a report on business trends, and a panel discussion on foreign trade and U.S. trade policy (page 494).

Earle S. Ebers has been named group vice-president of the U.S. Rubber Co. in charge of the polymer, fiber and chemical operations of the concern . . . Dudley Chittenden has been named vice-president and general manager of the Naugatuck Chemical Division (page 502).

Personalities in the news . . . E. R. Bridgwater, assistant general manager of DuPont's Elastomer Chemicals Department, will retire on January 1, 1961 (page 508) . . . R. F. Dunbrook, assistant research director at Firestone and well-known to the rubber industry, has announced his retirement (page 523) . . . Charles R. Haynes, for many years secretary of the Rubber Division, A.C.S., died on November 21 (page 522).

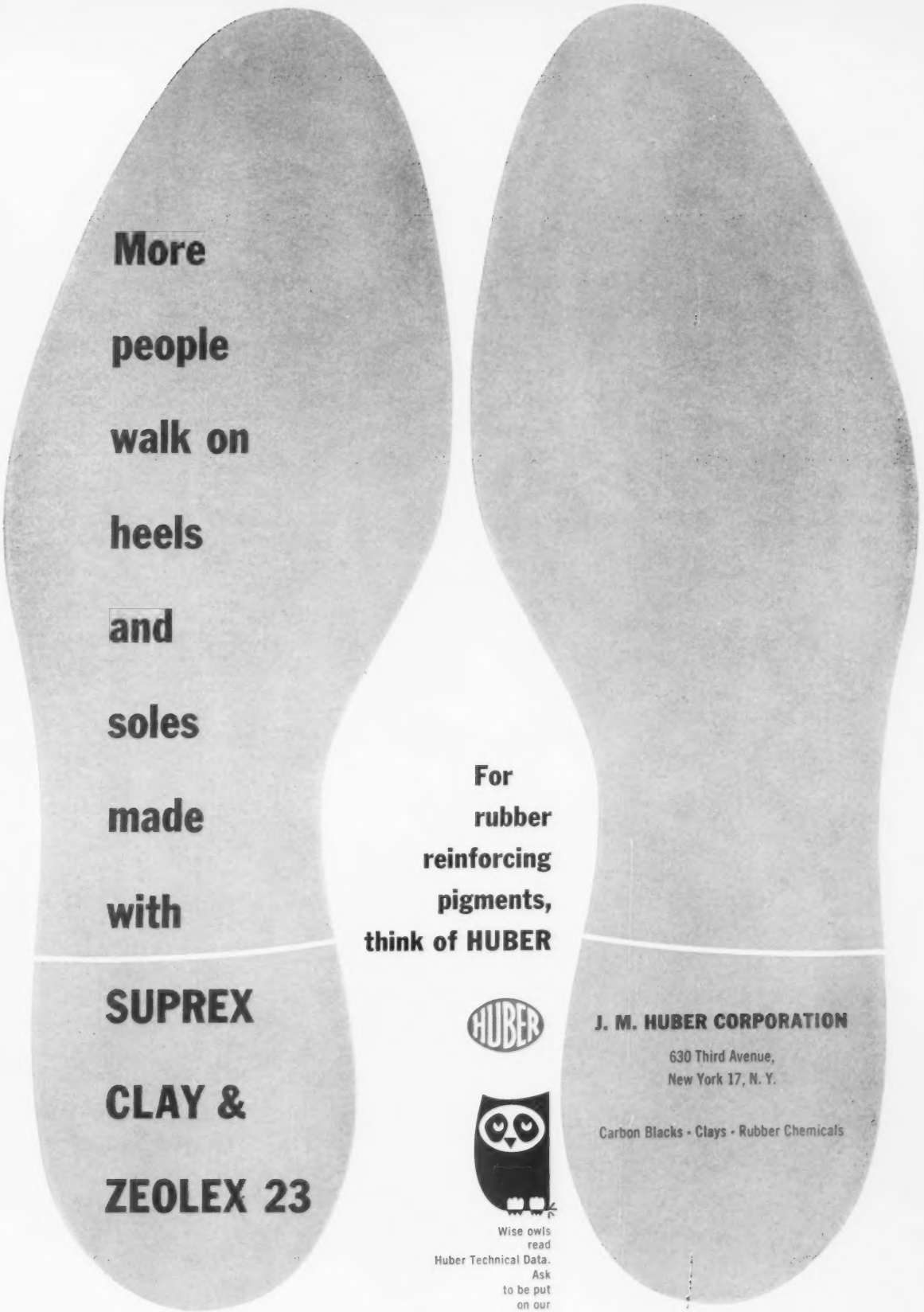
The formation of a Polymer Chemistry Group, affiliated with the Southeastern Texas Section of the American Chemical Society has been announced . . . The group already has 61 charter members representing 27 Gulf Coast companies (page 499).

Louis W. Cabot has been elected president and chief executive officer of the Cabot Corp. succeeding his father, Thomas D. Cabot, who has been elected chairman of the board of directors . . . Louis Cabot has been with the company since after World War II (page 501).

DuPont has announced plans to manufacture and sell neoprene in Japan . . . A new jointly owned Japanese company will be formed to handle manufacturing and marketing activities (page 502).

Nopco Chemical has broken ground at Chattanooga, Tenn., for the construction of a polyether urethane foam plant . . . The new plant will permit the company to serve Southern furniture manufacturers more efficiently (page 504).

Goodrich Chemical and R. T. Vanderbilt have announced plans for the manufacture of rubber chemicals in Argentina . . . It is planned that new production facilities will be located near Buenos Aires (page 506).



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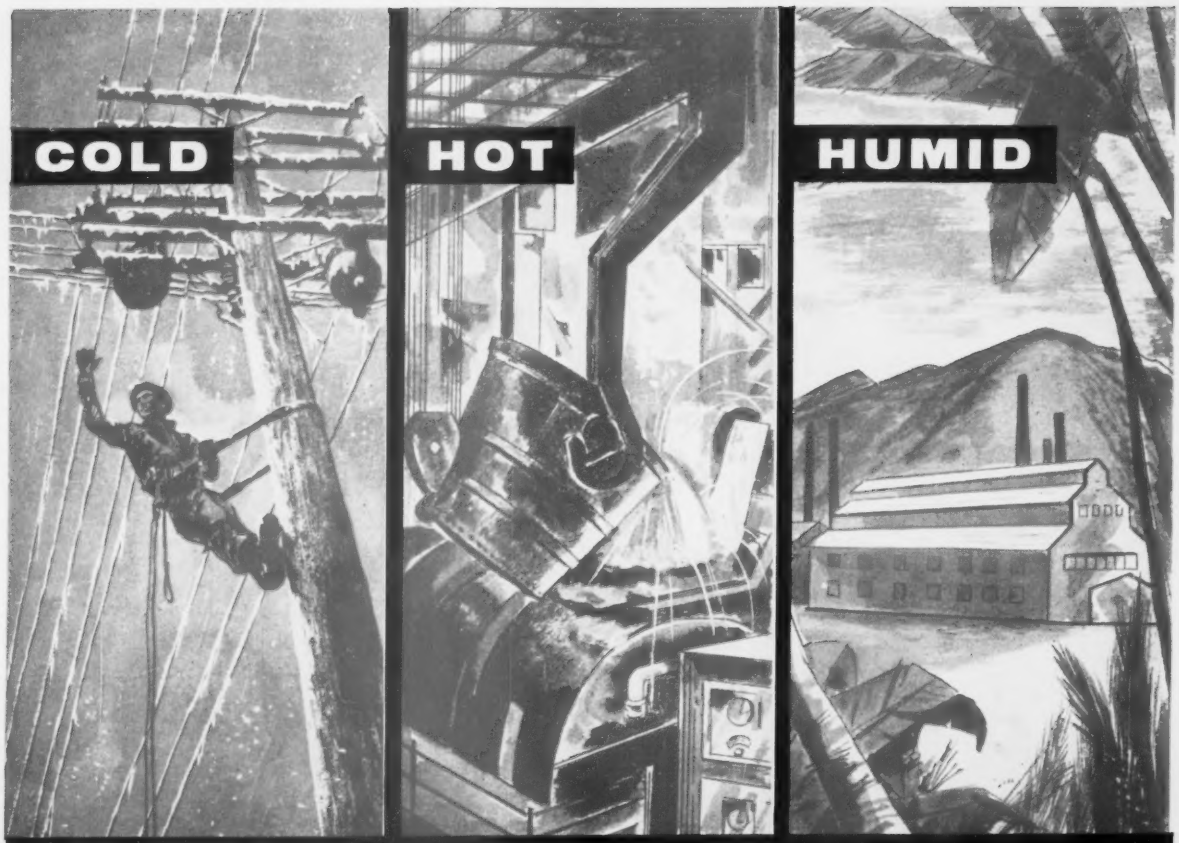

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The basic feature of new CHEMI-VIC is well described in the photograph above. That's CHEMI-VIC on the left, compared to a similar, currently popular elastomer, after 144 hours in an ozone box (100 pphm) at 100°F.

CHEMI-VIC is brand new—a vinyl reinforced nitrile elastomer. In addition to outstanding resistance to ozone and weather, it offers high physical properties plus exceptional resistance to oil. Moreover, it's easy to compound and process on standard equipment.

New CHEMI-VIC is available in two grades: CHEMI-VIC 400 for general purposes. CHEMI-VIC 800 for extrusion and calendering application. Typical uses: hose, belting, wire and cable jacketing, weather stripping, integral molded shoe soles. More information? Just write Goodyear, Chemical Division, Dept. X-9419, Akron 16, Ohio.

Lots of good things come from

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CHEMICAL DIVISION

Chemi-Vic—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photograph taken with the cooperation of Rubbermaid Inc., Wooster, Ohio.

They're knee-deep in selling points—thanks to PLIOFLEX

A big problem in manufacturing rubber kneeling pads is getting the right physical properties—every time.

The best answer one leading manufacturer found was to use PLIOFLEX 1510. It makes possible a more uniform open-cell structure, better tear strength, and generally superior product quality—*batch after batch.* Just as important, PLIOFLEX 1510 reduces sticking and permits a lower temperature cure during molding. And uncured trim scrap can be effectively reworked, further cutting processing costs.

If you're looking for ways to improve your product—and profit-picture—look closely at PLIOFLEX 1510. For technical details on "1510," or for assistance with your specific problem, just write to Goodyear, Chemical Division, Dept. X-9419, Akron 16, Ohio.

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Plioflex—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

Photograph taken through the cooperation of Acushnet Process Company, New Bedford, Mass.

WING-STAY 100 checks the effects of oxygen—and ozone

It's no easy task to develop a good brake cylinder boot compound.

Part of the problem is the frequent flexing under exposure to hydraulic fluid and heat. But equally important are the effects of oxygen and ozone degradation.

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Why don't you look into the extra protection of WING-STAY 100? Full details, including the latest *Tech Book Bulletins*, are yours at Goodyear, Chemical Division, Dept. X-9419, Akron 16, Ohio.

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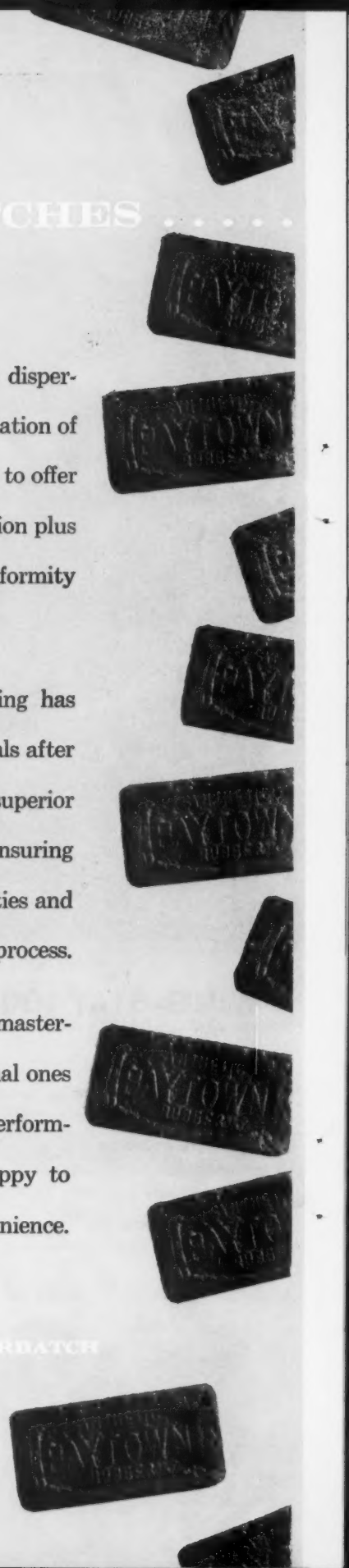
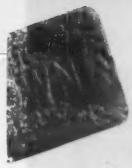
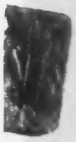
Service Laboratory and standard commercial compounding has shown that less residual nerve remains in these new materials after mixing on conventional Banbury cycles. Fast curing and superior tensile strengths have been recorded. Extremely low ash ensuring such desirable characteristics as improved electrical properties and lower moisture absorption result from the new coagulation process.

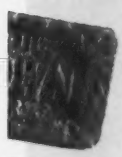
Today there are 17 new dispersant-free BAYTOWN black masterbatches to serve you. These masterbatches and the additional ones now scheduled for full-scale commercial production have a performance potential that merit your review. We would be happy to make available samples for processing review at your convenience.

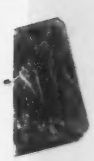


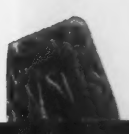
BAYTOWN...THE BIRTHPLACE OF BLACK MASTERBATCH











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A Reference Guide To The New Baytown Dispersant-Free Black Masterbatches

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12.5 parts highly aromatic processing oil
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100 parts SBR polymer
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rosin/staining

BAYTOWN 8675
100 parts SBR polymer
50 parts HAF black
9 parts naphthenic processing oil
rosin/staining

BAYTOWN 8676
100 parts SBR polymer
50 parts ISAF black
10 parts aromatic processing oil
rosin/staining

BAYTOWN 8677
100 parts SBR polymer
52 parts HAF black
10 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8678
100 parts SBR polymer
40 parts SAF black
5 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8679
100 part SBR polymer
40 parts SAF black
10 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8680
100 parts SBR polymer
52 parts HAF black
15 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8681
100 parts SBR polymer
50 parts ISAF black
15 parts highly aromatic processing oil
rosin/staining

BAYTOWN 8775
100 parts SBR polymer
75 parts HAF black
37.5 parts aromatic extending oil
mixed/staining

BAYTOWN 8776
100 parts SBR polymer
50 parts HAF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8777
100 parts SBR polymer
75 parts HAF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8779
100 parts SBR polymer
75 parts HAF black
37.5 parts naphthenic extending oil
12.5 parts naphthenic processing oil
mixed/non-staining

BAYTOWN 8780
100 parts SBR polymer
71.5 parts HAF black
51.25 parts aromatic extending oil
mixed/staining

BAYTOWN 8781
100 parts SBR polymer
55 parts ISAF black
37.5 parts aromatic extending oil
mixed/staining

BAYTOWN 8782
100 parts SBR polymer
68.75 parts FEF black
37.5 parts naphthenic extending oil
mixed/non-staining

BAYTOWN 8783
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80 parts FEF black
37.5 parts naphthenic extending oil
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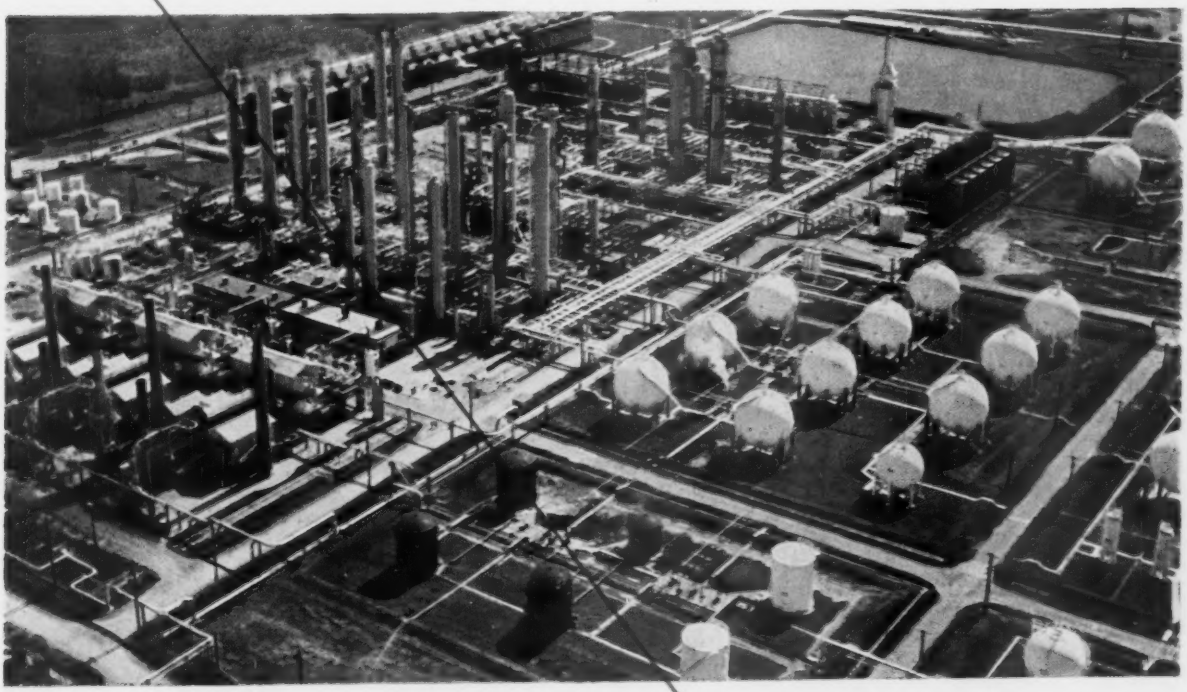

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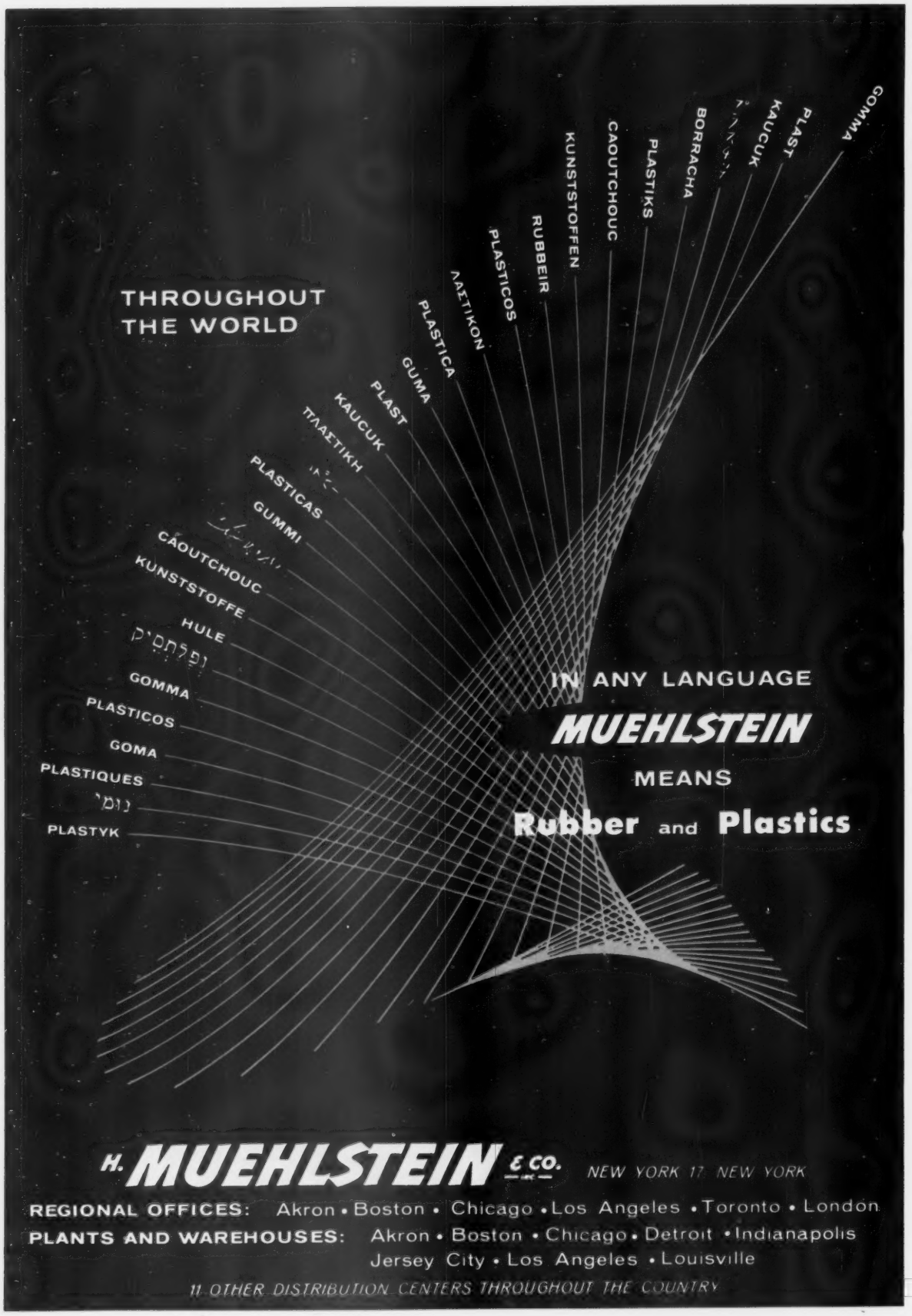

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capitol cues

A PROGRAM TO FIGHT A RECESSION is now taking shape in Washington. This doesn't mean top officials believe that we are heading for trouble. The Administration's line is still: "The business readjustment is nearly over." But policy-makers want some insurance, just in case business gets worse. All this is quite a switch from a month ago, when relatively little was being done.

The actions do not add up to a big-spending crash program. Rather, they involve stepped-up federal ordering and loans. Contracts spur the economy long before goods come off the line. The impact is felt as soon as firms start ordering.

Here's what the government has been doing:
- Defense: Contracts for previously-programmed missile and space projects may be increased 5% or more by year-end.
- Highways: The government is releasing hundreds of millions of dollars for superhighway work, well ahead of schedules.
- Reclamation: Allocation of new funds voted by Congress is being rushed by the Interior Department for water projects.

Efforts are also being made to stimulate housing, which is going through a slump. The government is making money more plentiful, shaving interest rates slightly. And the U.S. is raising prices it pays for GI and FHA-insured mortgages.

WHETHER THESE STEPS CAN BLOCK A SLIDE is still a very open question. As noted above, top U.S. officials, including the President, are optimistic. They are happy about high employment and the way inflation has been slowed. The fact that inventory buying dropped from billions to zero in only a year, with only mild dislocation, is taken to mean that the worst is about over. But many professional economists see a recession; a majority think it will be short and mild, but others among the experts are gloomy about prospects.

The pessimistic experts see no guarantee of a short decline. Why? Because the private sector just doesn't have much bounce.
- Demand for homes is no longer pressing. And with repayment periods so long, lower interest rates won't cut payments much.
- Consumer spending for autos, appliances, and furniture won't jump. People are putting more into education and services.
- Capital spending isn't likely to zoom, with so much capacity.
- Inventory buying won't rise much, with sales so sluggish.

Most of all, the gloomy economists fear that a long slide will snowball--that business will retrench and layoffs will spread.

CORPORATE PROFITS WERE UP ABOUT 10% in the third quarter over 1959. But the true situation is actually somewhat poorer than this figure shows. That's because the steel strike had already pulled earnings down last year. Gainers over 1959 included office equipment, nonferrous metals, railroads, steel, coal, oil, transport equipment, finance, food, beverages, tobacco. Losers included companies in machinery and the producers of such things as farm equipment, paper, chemicals, and textiles. Many drops were sizable.

capitol cues (cont'd)

STRIKES WILL BE FEWER IN THE COMING YEAR, say Labor Department experts. They base this on two things. One is softening business, which makes workers unwilling to risk jobs. The other is the General Electric contract--a union set-back; this is likely to put a damper on future strikes in other industries. Leaders won't be in a hurry to pull their men out after the GE debacle.

> Tougher management stands go far to explain what has been happening in labor disputes. In today's soft economy, it take a hot, clear-cut issue to arouse workers. Big issues next year will be wages and eliminating escalator clauses.

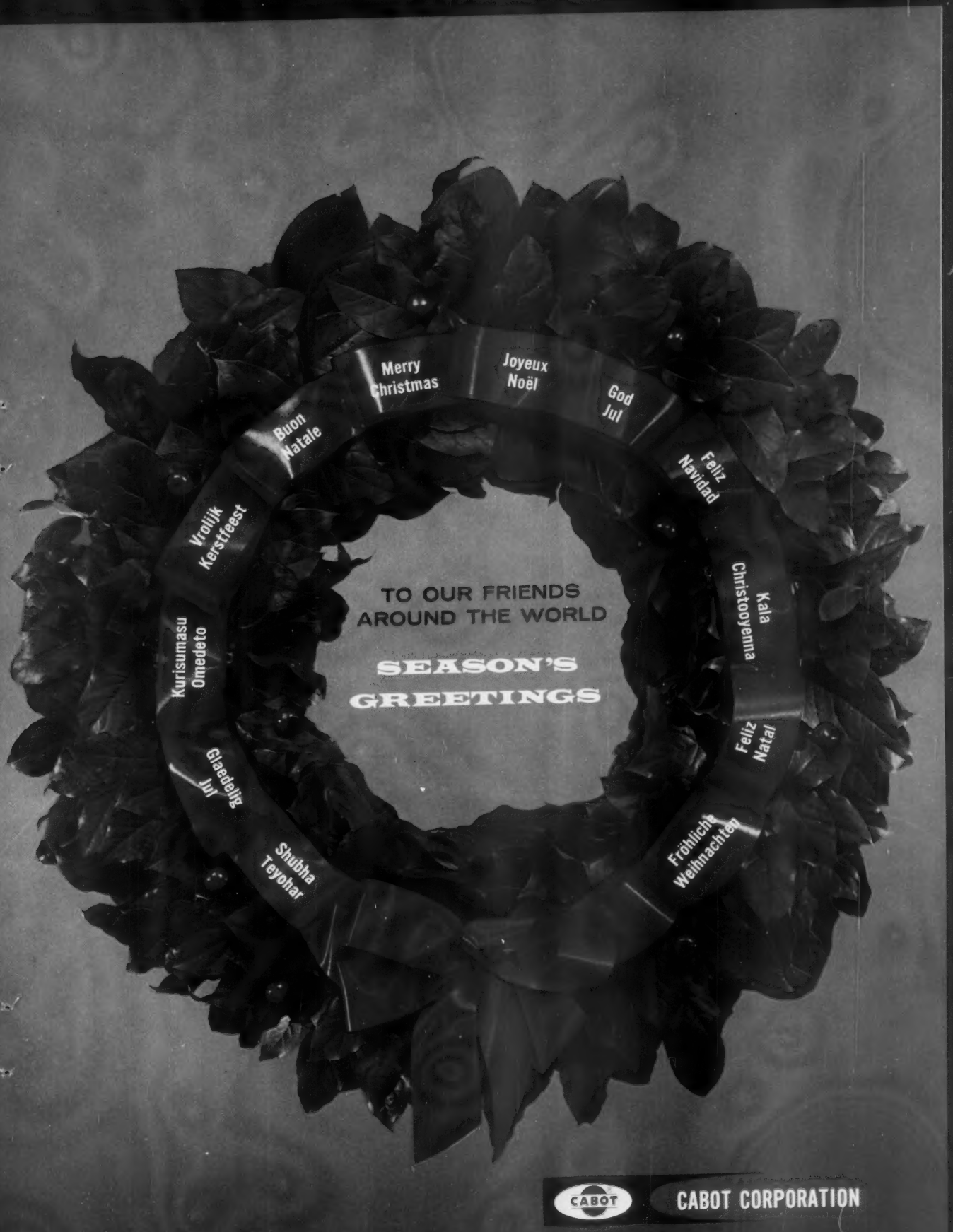
WAGE INCREASES ARE RUNNING A LITTLE LARGER this year than during 1959. For the first nine months, increases centered about a figure of 9.5¢ an hour. By contrast, the comparable figure for the past year was only 8.8¢ per hour. Clauses calling for deferred wage increases appeared in half of the contracts.

> Here's how the over-all figure breaks down:
> -In manufacturing, the central figure came to 8.2¢ an hour.
> -In nonmanufacturing, the median increase was 11.8¢ an hour.
> Labor experts believe the size of the gains will start to decline soon. This usually occurs when business slows down.

EQUITY-CAPITAL LOAN FUNDS FOR SMALL FIRMS will be expanded in the next six months. The lending potential of the Small Business Investment companies will double; the loan pool will go up to around $500 million. The number of SBIC's with licenses to operate will exceed 300 by mid-year, compared with a total of less than 200 at the present. The amount of funds will be swelled by U.S. loans and by stock sales as well as the investment of incorporators.

WORK ON 1961 LEGISLATION HAS ALREADY BEGUN in Washington, now that the election campaign is out of the way. House and Senate Committee staffs --and reelected lawmakers--are working on many issues that concern business. Among them are bills that failed to pass during the 1959-1960 session.

> Here's a quick look at what might happen on some key issues:
> -On defense spending, the Presidential debate over the strength of the nation assures an extra $1 or $2 billion in spending.
> -On labor, Congress will vote an increase in minimum wages; additional coverage, too, will be approved. The unions will ask a U.S. ban on state right-to-work laws. It won't pass.
> -On antitrust, prior government approval for the big mergers will be authorized. A national fair trade law may be passed.
> -On tariffs, Congress will vote another extension of the law for negotiating reciprocal trade agreements. This shapes up as one of the hottest fights in Congress, though. Advocates of high tariffs and quotas will be stronger next year and will get quotas on some items--oil, lead, and zinc, for instance.
> -On drugs, Congress probably will require producers to get prior government approval on the safety of their products. The government also will receive more power to check plants.
> -On depressed areas, a big assistance program will be voted.
> -On pollution, more federal funds will go to municipalities.
> -On education, the federal aid program will be expanded. But, it is doubtful whether funds will go to lift teachers' pay.



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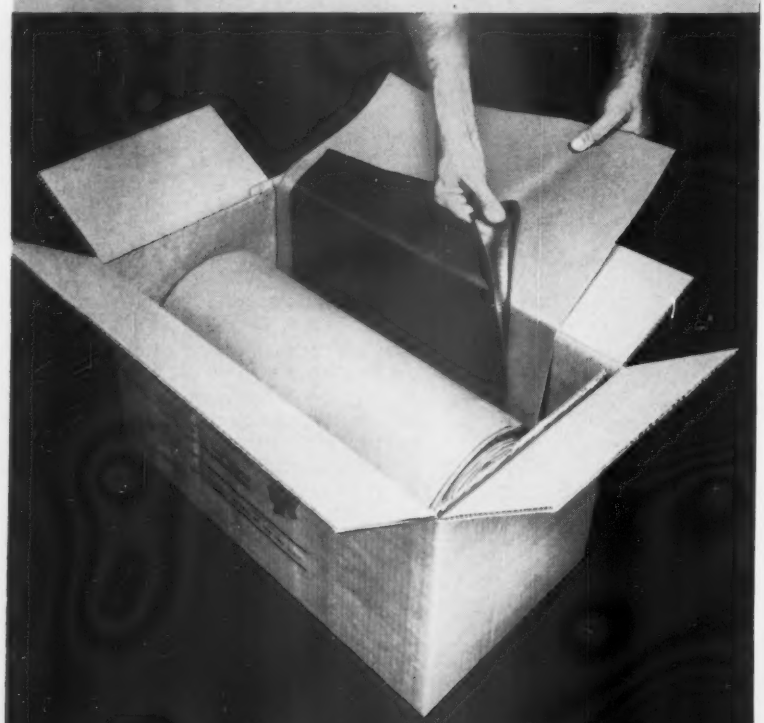

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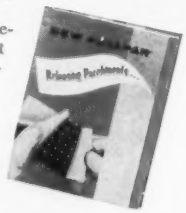

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News in Brief

► A new booklet, "Facts on B. F. Goodrich 'Airpath' Cushioned Rubber Floor Tile," is available from Flooring Products, B. F. Goodrich Co., Watertown, Mass. Listed are the properties, features and many types of applications for cushioned rubber floor tile.

► A 38-page catalog which provides engineering data, specifications and a price list on the Vibrolator line of vibration inducers has been announced by the Martin Engineering Co., Neponset, Ill.

► *Elastomer News* No. 9, May 1960, published by the Elastomer Chemicals Department of E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., covers such subjects as the use of neoprene in spot welding of hood panels, broader automotive use of Hypalon, and testing of neoprene and Viton in sports car applications.

► "Cydac Accelerator Flaked," put out by American Cyanamid Co., New York, N. Y., is designed as an addition to the Cyanamid Rubber Chemicals Catalog, and covers what the company terms a general purpose delayed action accelerator for use with natural rubber and butadiene-styrene copolymers.

► The Cleveland general office of Goodrich-Gulf Chemicals, Inc., has been moved to 1717 East 9th St., East Ohio Building.

► In line with a program of expansion and diversification, the name Eberhard Faber Pencil Co. has been changed to Eberhard Faber Inc.

► Naugatuck Chemical, Naugatuck, Conn., has made available Bulletin 234, entitled "New Improved Delac-S," as well as Compounding Research Reports No. 22 on Monex and No. 31 on Tuex and Ethyl Tuex. Monex is a general purpose ultra accelerator, and Tuex and Ethyl Tuex are ultra accelerators and vulcanizing agents.

► J. O. Ross Engineering, New York, N. Y., will open a new sales office in Mobile, Ala., to be headed by R. C. MacDuffee, who is currently in the company's office in Mt. Prospect, Ill.

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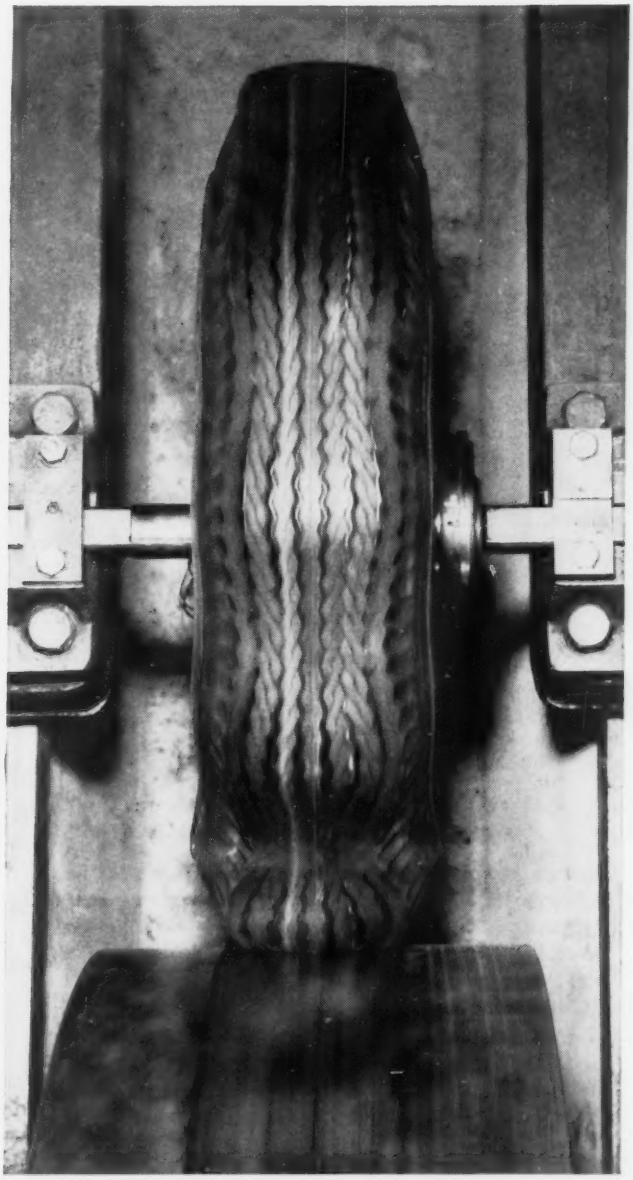
...for heat degradation and flex-cracking resistance



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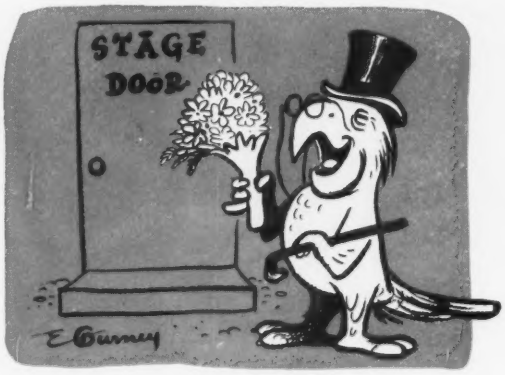
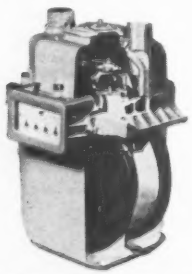


THIOKOL POLYSULFIDE CRUDES are PICKED FOR THE BIG JOB



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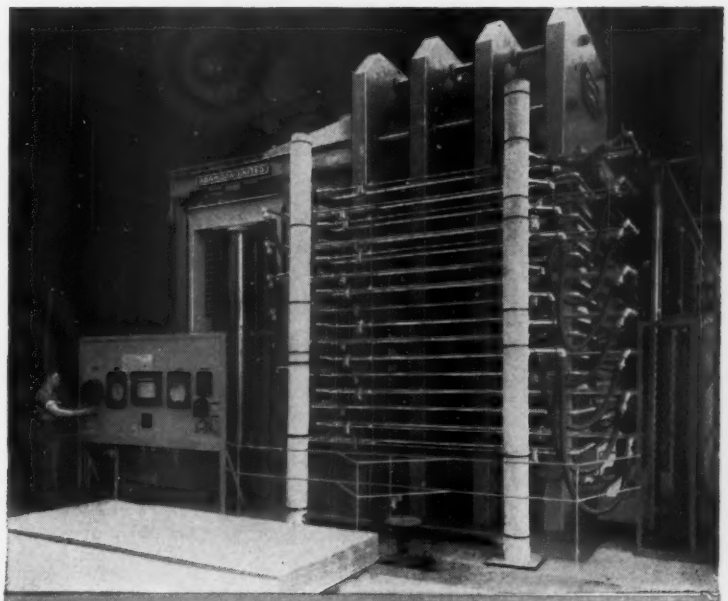

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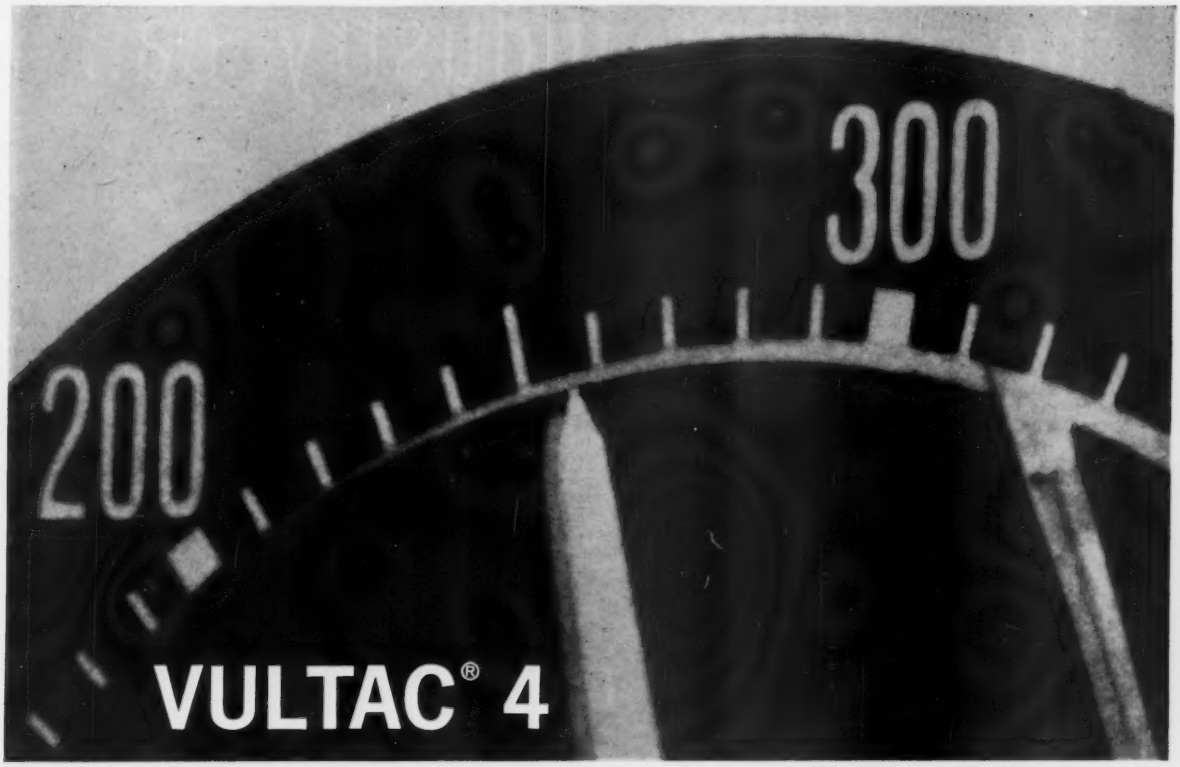

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Color and form	Hard brown resin	Hard brown resin	Slightly tacky brown resin
Softening range	50-60°C	78-93°C	48-58°C
Specific gravity 25/25°C	1.17	1.20	1.05-1.15

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Molecular Weight	164.14
Melting Point, °C	177*
pH of 0.1 M Aqueous Solution at 25°C	3.7
Solubility in 25°C, g/100 g solvent	
In Water	63.9
In 95% Ethanol	0.2
In Methanol	0.1

*Melts with decomposition.

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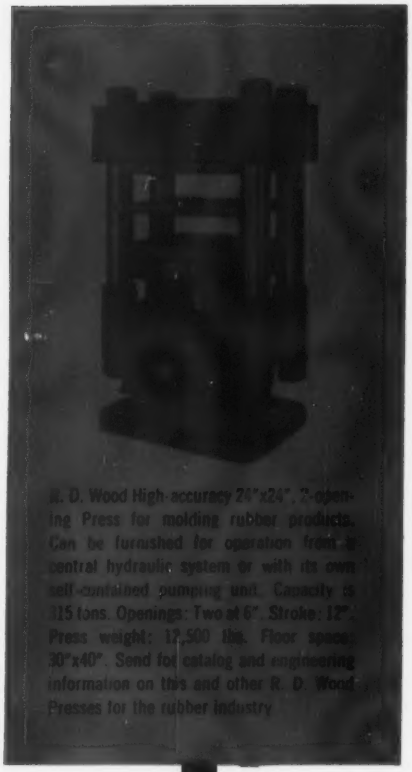

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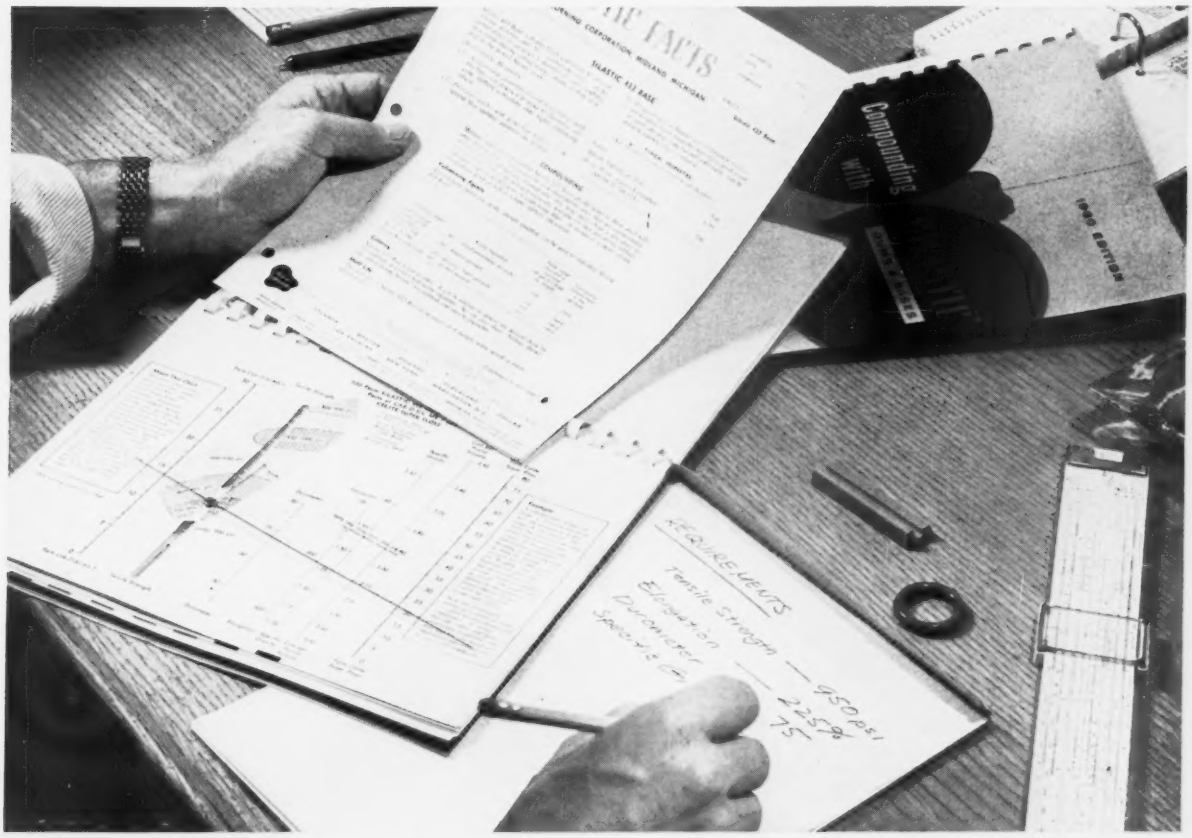
SILICONE NEWS from Dow Corning

The Compleat Compounder



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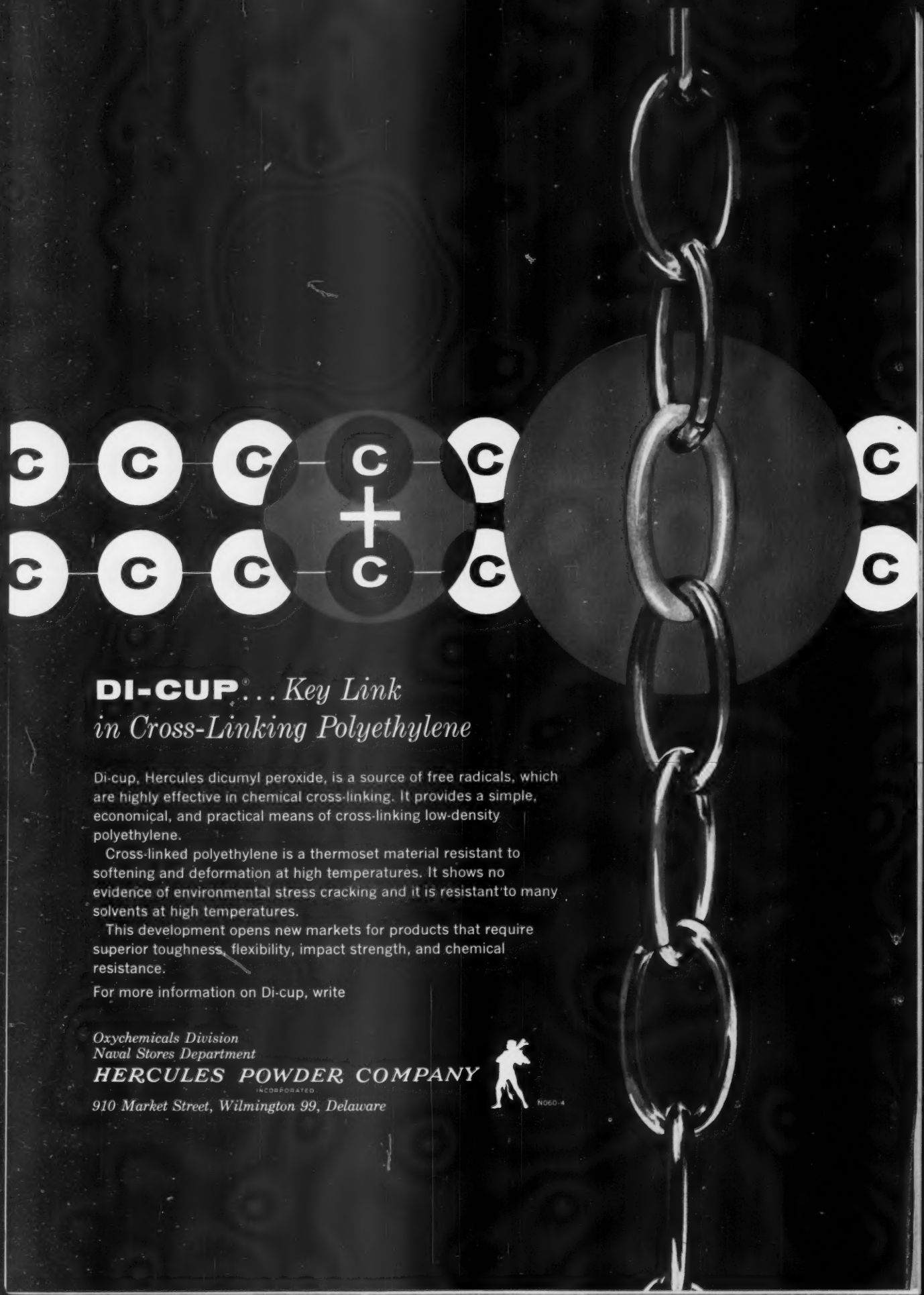

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• **German Synthetic Rubber Industry Expanding.** Chemische Werke Huels is setting up facilities for a 20,000 ton annual output of polybutadiene with an eye to supplying the outsize tire market. Huels also intends to hike its polyvinyl chloride capacity from 50,000 to 80,000 tons, to increase polystyrene capacity to 30,000 tons and polypropylene output to an annual rate of 3,600 tons.

In a 50-50 partnership with Houdry Process Corp. of the U. S., Huels has also formed a new subsidiary, Houdry Huels G.m.b.H., to produce catalyzers at Marl for the petroleum, chemical and petrochemical industries.

• **Belgian Bicycle Tire Sales Boom.** Growing sales of bicycle tires and inner tubes to the U. S. are one of the main reasons for extra recruiting of labor undertaken by Carideng S.A. at Lanaken (Belgium). The factory, which produces rubber goods in a highly streamlined fashion, manufactures about 50 per cent of Belgium's production of cycle tires and tubes. About 850 people are employed; only last year the export trade in tires and tubes with the U. S. became active. Inner tubes valued at $110,000 and bicycle tires valued at $315,000 were exported to the United States last year. Even though buying for the Belgian Congo is now on a smaller scale, larger export demand is pushing production to new peaks. Trade circles estimate that this year's tire production will be around 4 million units and that 3.8 million tubes will be manufactured. Carideng is also Belgium's only producer of rubber balls, which are mainly sold on the domestic market, although Great Britain is an important export customer.

• **Soviet Satellites Increase Export Drive.** India, a very promising export market, is the target of the trade offensive of the Russian satellites. We find in the recent issue of the *Indian Rubber Bulletin* a full page advertisement from Chemapol-Praha-Czechoslovakia, which, for the production of rubber goods, is offering accelerators, antioxidants, blowing agents, factices and reclaimed rubber. The Prague concern is represented by an Indian company with offices in Bombay and New Delhi. The full page ad is attractively designed and laid out. Ciech, the Polish Importer and Exporter of Chemicals, Ltd. in Warsaw, offers carbon black in two grades: condensed carbon black and granulated carbon black. They differ only in bulk density, which is explained in a very attractive half page ad. In order to enlighten the readers, the Polish organization deems it necessary to explain that carbon black is used in the rubber industry as a filler securing durability, elasticity, tear and abrasion resistance. The Polish trade association is represented by an agent in Calcutta.

We are happy to point out that a number of American concerns such as Phillips Petroleum International Corp., Columbian Carbon International, Inc., Firestone, Goodyear Chemical Division, Monsanto Chemicals, Witco Chemical Company, Continental Carbon Company, are also represented in this issue. Besides a number of advertisements of British firms, we find full page ads from Bunawerke Huels G.m.b.H., Farbenfabriken Bayer A.G. and others.

India is very receptive to American goods and offers a tremendous market. American manufacturers can contact the Bureau of Foreign Commerce of the U. S. Department of Commerce in Washington 25, D. C., submitting details regarding their line of products and inquiring at the same time what the chances of exporting these products to India would be. This service is paid for by all taxpayers and is, of course, free.

• **Oil Refinery in Rhodesia.** The Federal Government of Rhodesia and Nyasaland is considering a plan for an oil refinery for production of refined products from crude oil after being approached by American financial and oil interests. Raw materials for carbon black and plastics might also be produced. If the plan materializes, the refinery will probably be producing in three years.

• **Indian Bicycle Tire Company Seeks Investors.** An Indian bicycle tire company is inviting investments so it can purchase machinery and equipment for expansion of bicycle tire production. The present pilot plant is set up mainly for production of tubeless cycle tires and has a capacity of 1,000 tires a day.

The required capital for expansion is estimated at $500,000 of which 50 to 75 per cent will be used for machinery and equipment. The tubeless cycle tire is said to be manufactured under a special formula and vulcanizing process. It will fit any standard cycle rim, is puncture-proof and allegedly will outlast ordinary tires and tubes. Prospective investors are offered a pro-rated participation in the equity of the company as well as a share in the management. Those interested are invited to contact Mennanthara Rubber Works, Vadavathoor, Kottayan, Kerala State, India.

On The Continent (cont'd)

• **Hungary Buys Machinery from Free World.** England has recently received many machinery orders from Hungary, among them one for the installation for a rubber processing plant. West Germany also competed for a number of orders and also got a large amount of business. More competitive pricing by the Germans has given them a rubber tire factory sale and a polyvinyl chloride plant equipment sale in recent months. The latest West German prize went to Krupp for $4.2 million worth of machinery and machine tools for a Hungarian rubber factory.

• **Kuala Lumpur Conference Paper.** The Mechanico-Chemical Synthesis of Superior Processing Rubber was the theme of one of the papers delivered at the recent natural rubber conference in Kuala Lumpur. The author stated that a comparison was made between the superior processing properties bestowed upon natural rubber by: a) the addition of a proportion of prevulcanized latex to the natural rubber latex prior to the coagulation and formation of dry rubber; b) the addition of partially vulcanized dry natural rubber to natural sheet rubber; c) the gelation of sheet rubber by mastication with cross-linking additives.

Mechanico-chemical cross-linking was achieved by representative materials from the classes of multifunctional alkoxides, phenolic resins, unsaturated hydrocarbons and anhydrides.

• **Hong Kong Offers Favorable Market.** The first overseas branch of the Japanese department store firm, Daimaru Inc., opened in Hong Kong on November 3. This new store is modern in every respect and it is expected to be highly competitive with the colony's somewhat old-fashioned department stores. Refrigeration equipment for its food department, as well as 200 cash registers, has been supplied by U. S. firms. Additional department stores and supermarkets are being planned in Hong Kong, and U. S. suppliers of consumer goods have an excellent opportunity to participate in the market for import items.

Opening day response was enthusiastic, and the wide assortment of retail goods displayed included such U. S. merchandise as shirts, refrigerators, packaged foods and a number of rubber goods. Merchandise offerings should be addressed to Daimaru Inc., Department Store, Hong Kong.

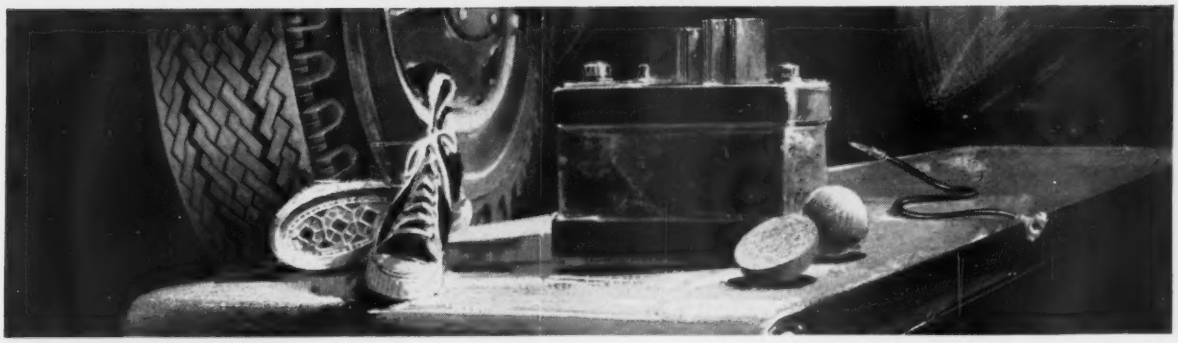
• **Outlets For Rubber Shoes.** The Commercial Intelligence Division of the Department of Commerce, Washington 25, D. C., has published new trade lists and is offering mimeographed copies at $2 a list. Most of these lists are prefaced by a brief review of basic trade and industry data collected in making the compilations. All lists are dated as of October 1960. The following trade lists are among those available: Boot and Shoe Importers, Dealers and Manufacturers in Austria; Boot and Shoe Importers, Dealers and Manufacturers in Denmark; Boot and Shoe Importers, Dealers and Manufacturers in Pakistan; Boot and Shoe Manufacturers in India. This list was compiled in November 1960, Boot and Shoe Importers, Dealers and Manufacturers in Portugal.

Many American models and styles are very attractive to the countries which are listed. Because the purchasing power of most of these countries has increased considerably during the last few years, the customers are willing to pay a higher price for a more attractive American article. We would encourage all our manufacturers of rubber footwear to obtain these lists and look them over. Have a very nice letter drawn up in the respective languages such as German, Danish, English and Portuguese. A translation bureau will do the translating for a very modest fee.

The results will surprise you. Many people are looking for American merchandise. For instance, Pedro A. Phillip Co., Ltd., manufacturer's agent, distributor, commissioned merchant and importer, at 17 Henry Street, Port of Spain, Trinidad, is very interested in selling American rubber footwear. The special report, a world trade lead, costing $1 is available through the Commercial Intelligence Division of the U. S. Department of Commerce in Washington 25, D. C.

• **Warning for Snow Tire Users in Germany.** The Germans do not have enough experience with snow tires. It is for this reason that the Dunlop Tire factory warns the German public when using snow tires on thruways not to exceed a speed of 90 miles an hour. On certain parts of the German thruways—Autobahnen—there is no speed limit; consequently everybody tries to outdo the other fellow and speeds exceeding 100 miles an hour are not an exception. Many accidents have been caused by such excessive speed and it is for this reason that this timely warning has been issued to the German drivers. Judging by American standards, we are of the opinion that it would have been preferable to indicate a maximum speed of 50 or 60 miles or even less in order to reduce the accident rate.

• **American Exports to Eastern Europe.** Among commodities approved for export to the Eastern area in the third quarter of 1960, were tire fabrics worth $1,266,946 exported to the U.S.S.R.



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Firestone's Diene is strikingly superior to natural rubber in four important respects: resilience, abrasion resistance, high dynamic modulus and low temperature properties. In processing, it possesses a complete lack of "nerve." In content, it is extremely pure with no gel, no moisture and extremely low ash. The water soluble ash is nil, providing excellent electrical properties. Its aging and cracking resistance: better than natural rubber.

Diene is perfectly compatible with Styrene-Butadiene and natural rubber. When combined with them in major proportions, it lends startling new properties to the resultant compound—properties that expand and excel the best features of each polymer.

Truck tires combining major proportions of Diene with natural rubber were road-tested for more than three million miles with amazing results. The Diene tire's wear resistance proved stubborn and startling. Its traction is quick and eager, gripping slick surfaces when other tires spin. It runs cooler at all speeds and gives a measurable boost to gasoline mileage. Moreover, Diene promises to make equally dramatic improvements in other rubber products.

Firestone's new Diene plant—beginning operations January, 1961, in Orange, Texas—is the first to be built by any rubber company. It is another symbol of Firestone's continuing determination to have complete production facilities to make a quality rubber for *every* purpose.

Firestone Diene will be available to all rubber product manufacturers. You are invited to write Department 23-1 now for development quantities and technical information.

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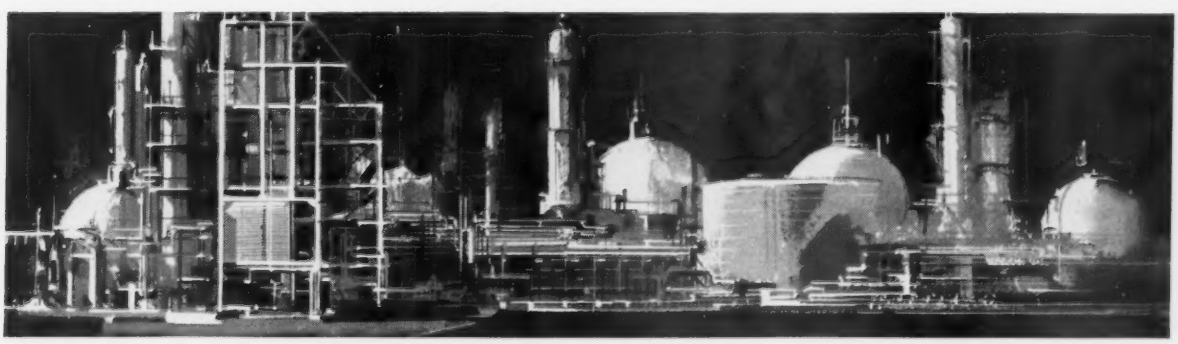

Helping Dreamers to Dream Keeps America Strong

"We are the music-makers,
And we are the dreamers of dreams . . .
Yet we are the movers and shakers
of the world forever, it seems."

Arthur O'Shaughnessy, The Music-Makers

Throughout our history as a nation—indeed, throughout the history of all mankind—it has been the dreamers of better ways of doing things who have made our lives more worthwhile.

And yet the dreamer of today, if he is to contribute to the betterment of his fellow man, must be an *educated* dreamer. He must have assimilated the knowledge and undergone the training that enable him to dream *beyond* the present, beyond the knowledge we have now.

Can there possibly be a better reason for strengthening the *sources* of knowledge—colleges and universities?

It seems incredible that a society such as ours which has profited so vastly from an accumulation of knowledge—and from the fulfillment of dreams—should allow anything to threaten these wellsprings of our learning.

The crisis that confronts our colleges threatens to weaken seriously their ability to transmit the knowledge and to encourage the dreams that will keep America strong.

The crisis is composed of several elements: a salary scale that is driving away from teaching the kind of person *best qualified* to teach; overcrowded classrooms; and mounting college applications that will *double* in less than ten years.

Help the colleges and universities of your choice. Help them plan for stronger, better-paid faculties and for expansion. The returns will be greater than you think.

If you want to know more about what the college crisis means to you, and what you can do to help, write for a free booklet to: HIGHER EDUCATION, Box 36, Times Square Station, New York 36, N.Y.

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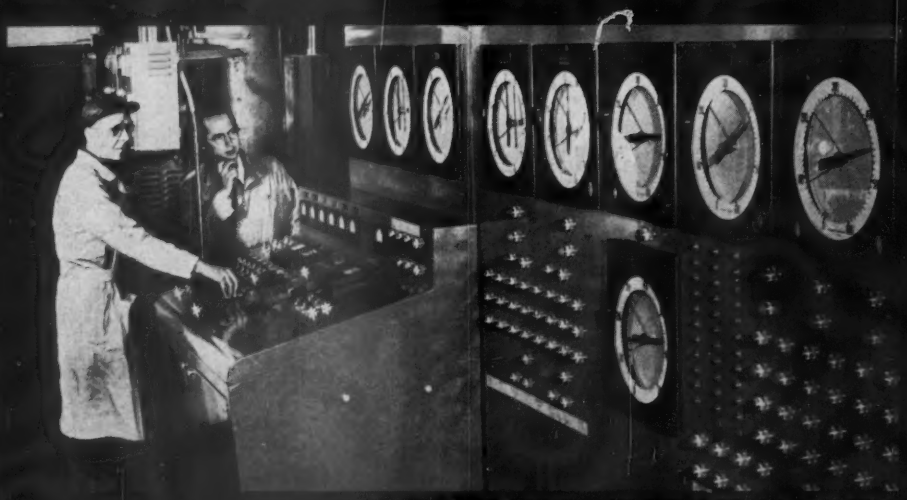

Control Center — Calendar Treating Line Photo courtesy Armstrong Rubber Manufacturing Co.

Whether the simplest kind of equipment installation — or the world's first triple-zone rayon/nylon calendar line as shown here — the moment of startup is the culmination of months of calculation and construction . . . an inexorable test of soundness of engineering, skill of manufacture and field erection.

This unique new process line — highly advanced in operation and control — performed at startup, and after a brief two-week testing and minor adjustment period exploring the multiple operating possibilities, went into full-time production at 60 ypm.

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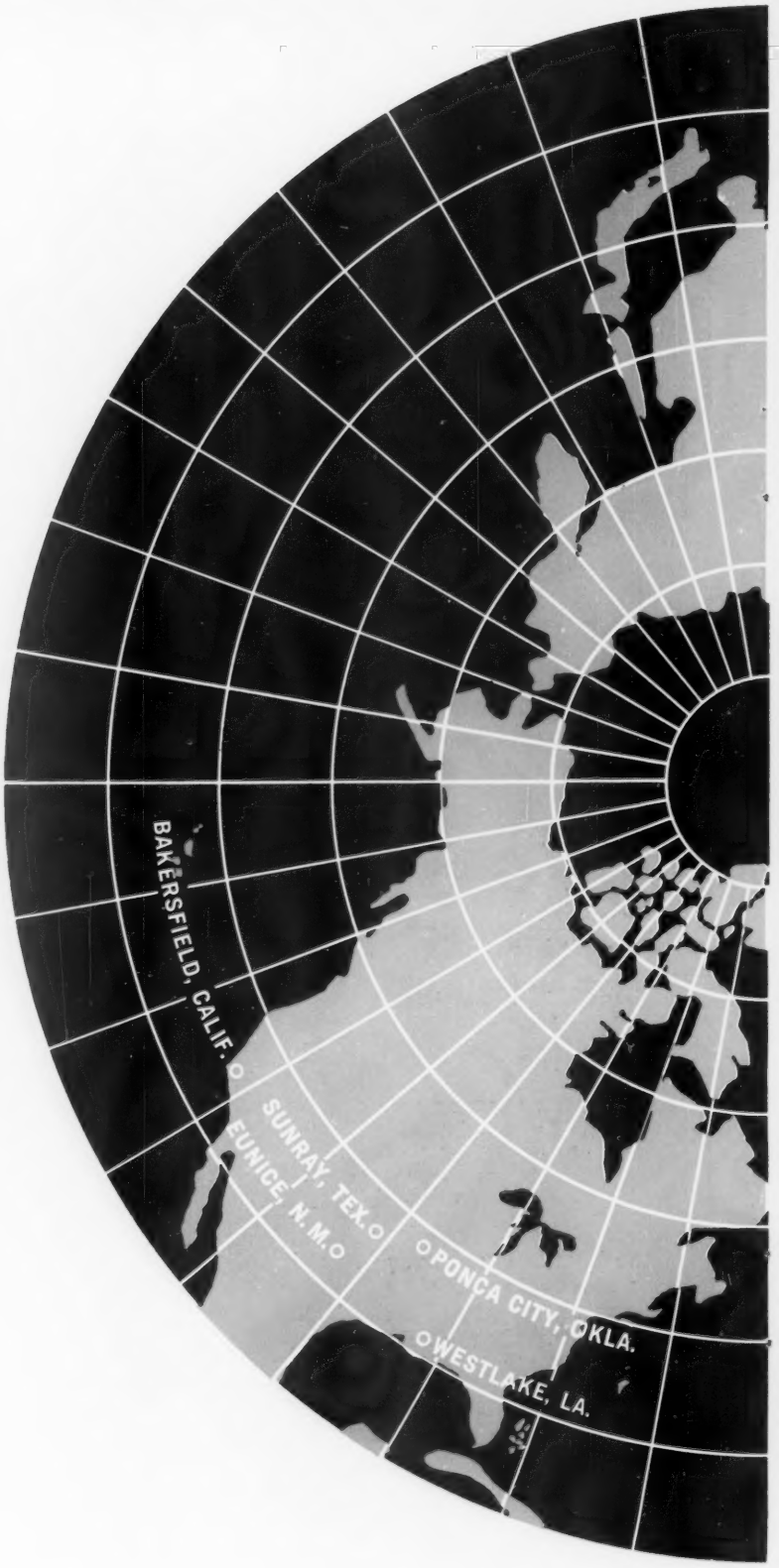

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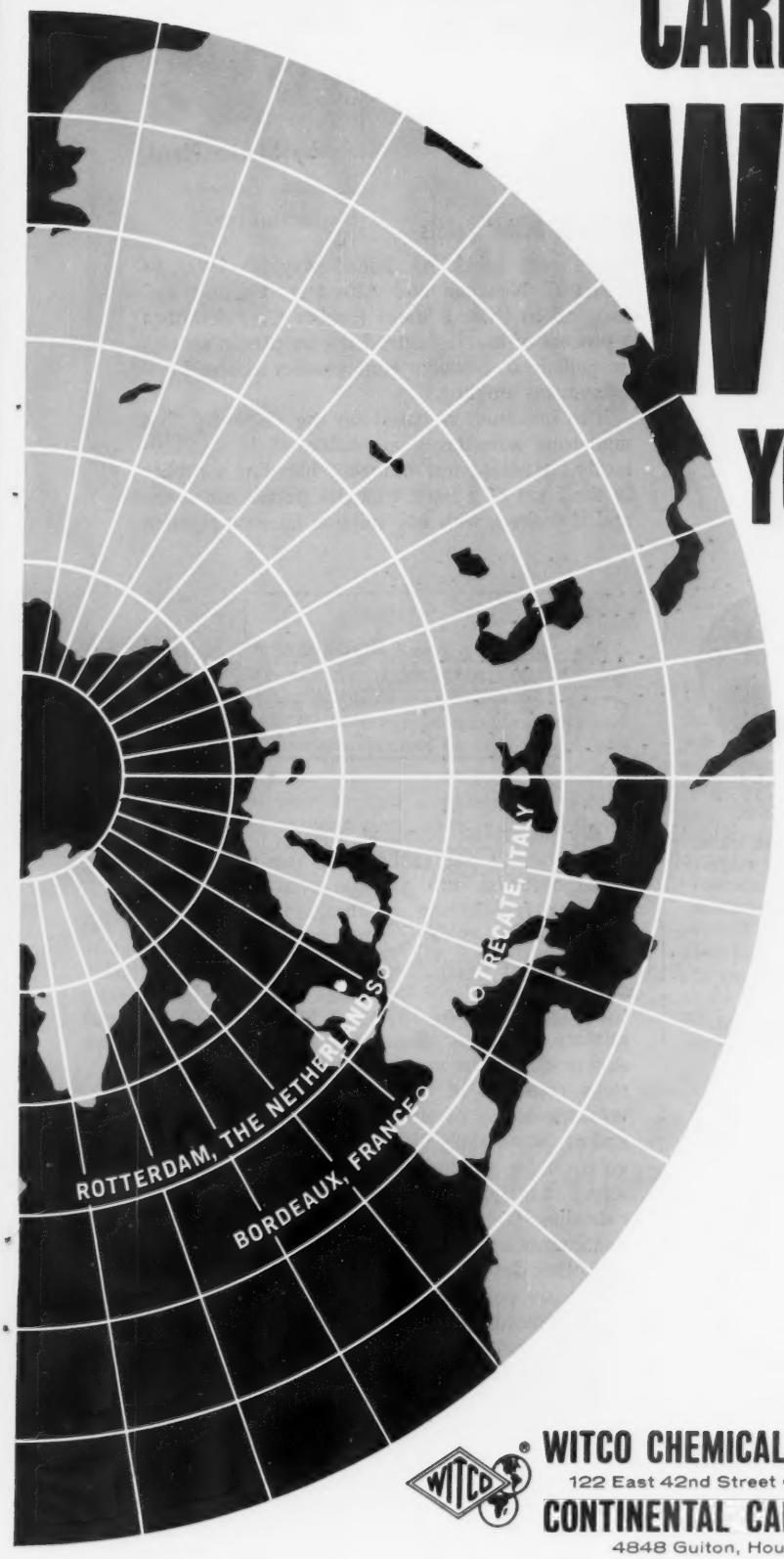

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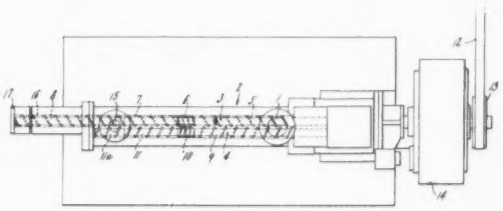
PATENT REVIEW

by Melvin Nord

Synthetic Rubber Pellets

U.S. Patent 2,935,763, issued May 10, 1960, to Ferris E. Newman and Alfred A. Guthrie and assigned to United States Rubber Co., describes a process of making extruded gum plastic articles or pelletized granular gum plastics adapted for subsequent molding.

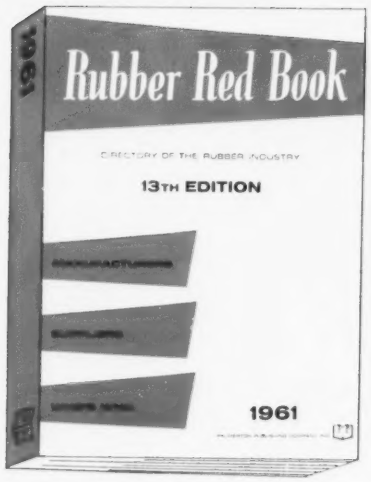
The invention is based on the discovery that numerous advantages are achieved by preliminarily intimately and uniformly blending a rubber in the form of a latex with dry particulate resin, and if desired, with any suitable filler or pigment



in dry particulate form, at a temperature below that at which the rubber and the resin would undergo fusion into a single phase, to form a granular free-flowing mixture, masticating this mixture at an elevated temperature and thereby effecting consolidation of the mixture and fusion of the resin and the rubber into a single phase, removing water and any other volatiles from the mixture during or after the preliminary blending step or during the masticating step or during both steps (removal of the bulk of water and other volatiles during or after the preliminary blending and of substantially all remaining water and other volatiles by evacuation during the masticating step being by far the preferred procedure), and extruding the resulting mixture either into the continuous final form, e.g., pipe, rod, channel or any other desired shape, or into strands or strings which are pelletized to molding powder in subsequent molding or extrusion operations.

New results, manifested chiefly by better physical properties in the final extruded or molded article and by materially lower cost of manufacture, are achieved by proceeding in the manner outlined above.

It is believed that the use of rubber in latex form results in a complete encasement of the individual particles of resin, and of a filler (including pigment) if used, in the preliminary blending operation and that the grinding, kneading and smearing action in the subsequent masticating



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For the convenience of users, the names and addresses of suppliers, formerly included at the end of each individual section, have now been consolidated into one complete alphabetical list. Sales and export offices, where furnished, are shown in a number of cases. Telephone numbers, too, have been included for convenience.

The Encyclopedia of the Industry

The RUBBER RED BOOK contains data on rubber manufacturers in the United States and Canada . . . geographical location of rubber plants and factories . . . rubber products . . . rubber machinery and equipment . . . laboratory and testing equipment . . . accessories and fittings . . . rubber chemicals and compounding ingredients . . . fabrics and textiles . . . natural rubber and miscellaneous gums . . . synthetic rubbers and rubberlike materials . . . reclaimed rubber . . . scrap rubber and plastics . . . latex and related materials . . . miscellaneous products and services . . . consultants . . . educational courses in rubber chemistry and technology . . . trade and technical organizations throughout the world . . . technical journals . . . and a comprehensive Who's Who in the Rubber Industry. All brought together in a single, easy-to-use volume for your convenience.

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PATENT REVIEW

step results in fine subdivision and high attenuation of the resin and particles, uniform inter-mixture of the rubber and resin with one another, fusion blending of the rubber and resin and distribution of the resulting blend around the particles of any filler under the pressure of mastication.

The step of substantially completely removing water and other volatiles during the process also contributes in an essential manner to the attainment of the new results. There is evidence that where traces of volatiles remain in the product leaving the extruder, these result in blistering in directly extruded articles like pipe and in articles molded from the pelletized extruded mixture. In addition, such traces of volatiles in the pelletized extruded mixture lengthen the time required in molding articles therefrom.

As shown in the illustration, the blended mixture is charged through the opening (1) of the twin-screw compounding, evacuating and extruding device (2) which consists of a main screw (3) and an auxiliary screw (4). These screws are of unequal length and equal diameter and are rotated in opposite directions. The main screw (3) embodies a feed portion (5), a compounding portion (6), a milling portion (7), and an extruding portion (8). The auxiliary screw (4) includes a corresponding feed portion (9), a corresponding compounding portion (10), a corresponding milling portion (11), and a short extruding portion (11a).

The screws (3 and 4) are driven through the medium of a belt (12), a pulley (13), and a reduction gear box (14). The feed portions (5 and 9) feed and compact the charged material and forward it into the compounding section where it is compounded by the action of the screws (6 and 10) which have a very low pitch compared to the rest of the screws (3 and 4), and subject the material to intense masticatory action and fusion blending.

Then the material passes into the milling section where it is further milled by the action of screws (7 and 11). As it near the end of this milling section, it is subjected to vacuum through an opening (15). The vacuum withdraws the water and the other volatile components of the mixture. The action of the screws serves to continuously expose fresh portions of the mixture to the vacuum applied through the opening (15), which, coupled with the fact that the vacuum is applied over a substantial portion of the mixture in the milling and extruding sections, results in effective removal of remaining volatiles. At the forward end of the milling section, the milling chamber merges into a conventional single-opening extrusion chamber (16) in which the extrusion screw (8) operates in the conventional manner to extrude the material through the die (17).

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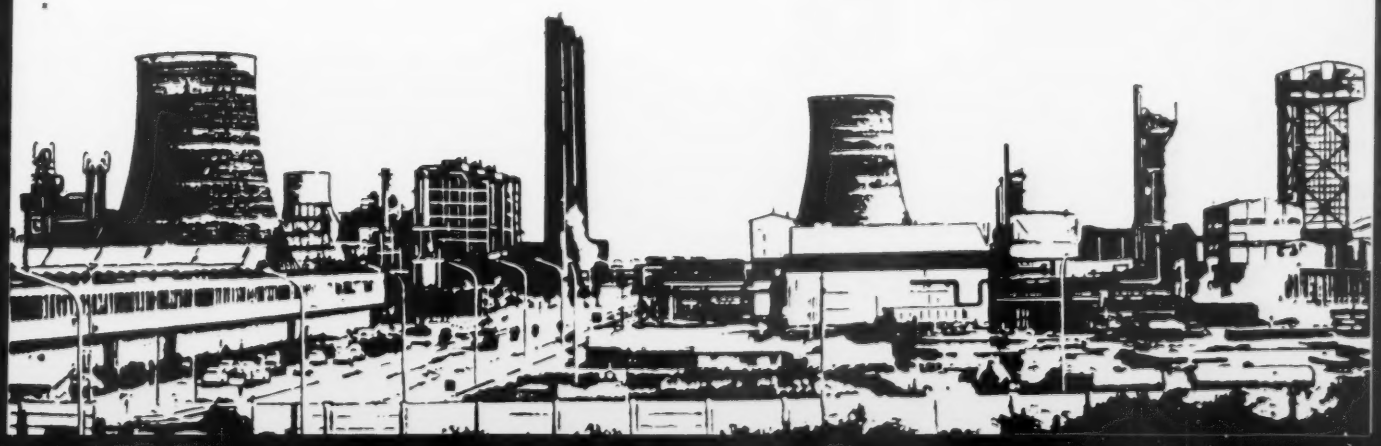

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Here at last is the answer to your problems of dicing rubber or vinyl sheet stock. Produces perfect cubes ranging in size from ⅛ to ½" by merely changing knives.

Comes in two sizes designed to handle sheets up to 7" or 14" in width. Other sizes made to order.

Input speeds range from 10 to 125 feet per min. depending on material and size of cube desired.

The CUMBERLAND Rotary Chopping and Dicing Machine

As a chopper, this machine efficiently cuts rubber and vinyl slabs into small pieces. Two sizes available to handle stock widths up to 14 or 24 inches.

As a dicer in modified form, handles principally vinyl sheet stock. A less expensive machine though less universal than the "Stair-Step" Dicer shown above.

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PATENT REVIEW

Conductive Latex Films

U. S. Patent 2,929,108, issued March 22, 1960 to Arthur G. Sands and assigned to the Secretary of the Navy, describes a method for preparing electrically conductive latex films in an electrically stable condition. It was found that cured, conductive latex films of high electrical stability can be obtained by subjecting the uncured latex conducting film to leaching in boiling water. This extracts the water-soluble materials from it. The leached conductive films can be cured in the usual way, for example, by hot air curing at 250° to 300° F.

Cellular Cured Rubbery Products

U. S. Patent 2,927,904, issued March 8, 1960 to William T. Cooper and assigned to Phillips Petroleum Co., provides a method of producing a rubbery cellular product. Rubber and an olefin polymer, such as ethylene polymer, are blended with a chemical blowing agent. After heating to decompose the blowing agent, it is cured to yield a cellular thermoset product. End products of this process are more resistant to deflection under load than similar compositions made without olefin polymer.

Other Patents of Interest

Subject	Inventor or Assignee	Patent No.	Date
Endless slide fastener closure	The B. F. Goodrich Co.	2,928,155	3/15/60
Apparatus for manufacturing rubberized fabric articles	The Firestone Tire & Rubber Co.	2,929,101	3/22/60
Apparatus for shaping and vulcanizing an air spring	The Firestone Tire & Rubber Co.	2,929,103	3/22/60
Flexible coupling	The Firestone Tire & Rubber Co.	2,929,231	3/22/60
Anti-skid tire	The Goodyear Tire & Rubber Co.	2,929,427	3/22/60
Tubeless tires	The Firestone Tire & Rubber Co.	2,929,429	3/22/60
Apparatus for filling tires with liquid	The Goodyear Tire & Rubber Co.	2,929,432	3/22/60
Neoprene cement	The Firestone Tire & Rubber Co.	2,929,805	3/22/60
Tire	Pirelli S.p.A.	2,930,425	3/29/60
Equipotential wire breaker for a tire	United States Rubber Co.	2,930,426	3/29/60

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Gone are the days of rejected merchandise because of yellowing on the shelves, fading and other "appearance failures." Glidden *Zopaque* Titanium Dioxide assures *certain* optical qualities: high opacity, hiding strength and tinting power.

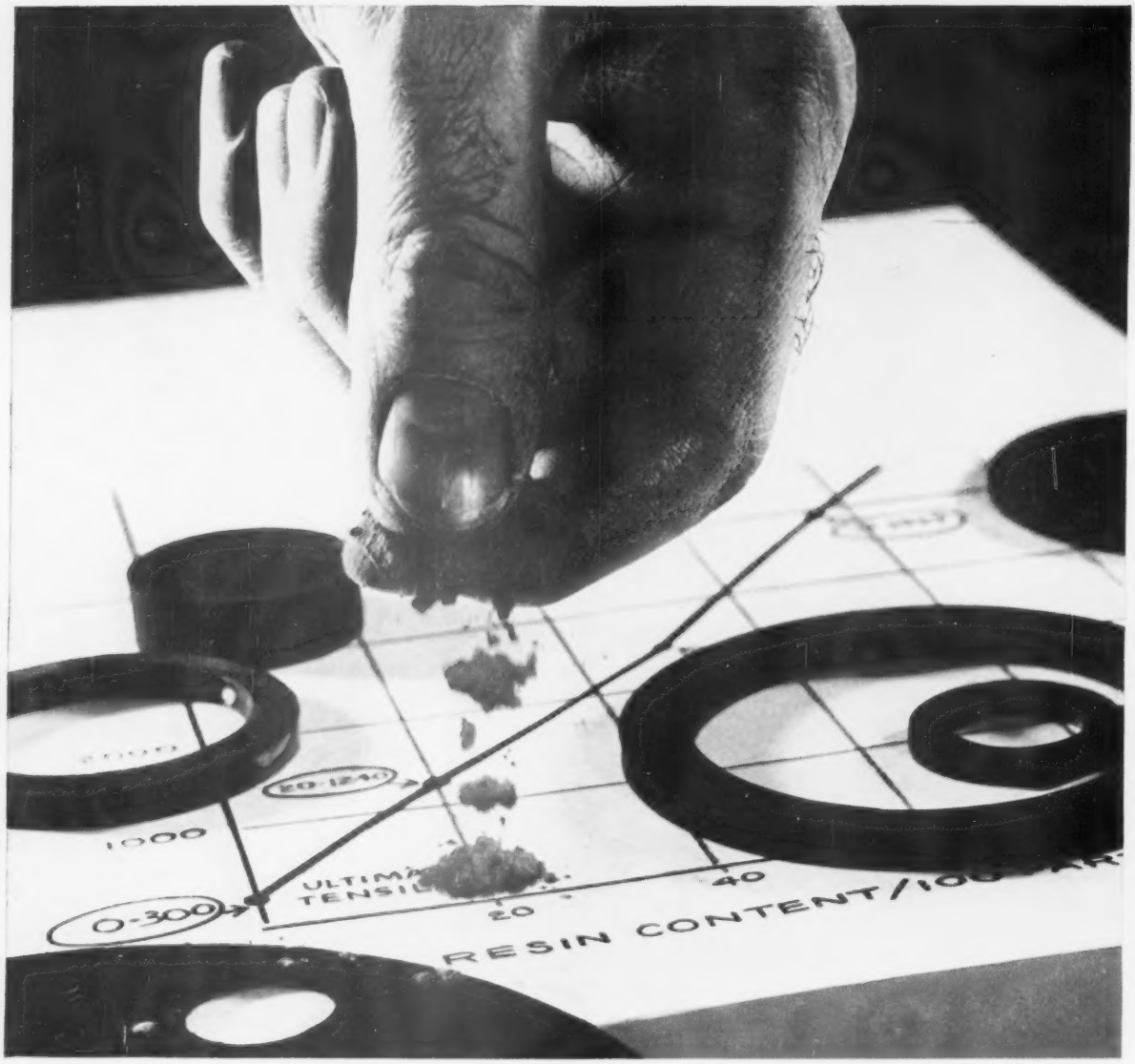
Let Glidden *Zopaque* help you make your product (easily dispersible in rubber compounding) and sell your product through clean, bright, new, "BUY ME" eye appeal!

Write or call for complete information.

QUALITY Glidden PRODUCTS

THE GLIDDEN COMPANY
FINEST PIGMENTS FOR INDUSTRY
Chemicals Division • Pigments and Color Department
Baltimore 26, Maryland

(This advertisement is printed on paper stock containing Glidden *Zopaque* Titanium Dioxide.)



Add a pinch of permanence...

and watch the good properties grow

Mix a little Durez phenolic resin with nitrile rubber, and notice how the performance curves of the vulcanizate shoot upward.

In a typical recipe, ultimate tensile zooms from 325 to 1330 when you add only 20 parts of resin on 100 parts of nitrile rubber.

Increase it to 50 parts of resin, and tensile goes to 2600. Shore A hardness swings up steeply. Elongation drops off. Stiffness and abrasion resistance both climb.

These properties don't disappear, either, when the going gets rough. After 70 hours at 212°F in air, they're virtually undiminished. You get *more permanence* than with other types of resin.

Fast cure without sulfur: Using 75 parts or less of resin on 100 parts of nitrile rubber, you can cut down on your sulfur and accelerators—and still get a rapid, complete cure.

On 100 parts or more of resin, you can *forget* sulfur and accelerators. The resin provides all the reactivity you need to cure the rubber, with or without filler, and often in record time.

Think of the advantage a no-sulfur compound gives you in gaskets or other molded pieces that must coexist with a lead-oxide paint or must remain neutral in an electrical environment.

You can get Durez resins for modifying the properties of nitrile rubber or SBR, natural rubber or Neoprene, and for making solvent-type adhesives that stick better. They come in powders, lumps, liquids, and emulsions to suit your process. To find out more about them, write us for the illustrated bulletin "Durez Resins in the Rubber Industry."

DUREZ PLASTICS DIVISION

112 WALCK ROAD, NORTH TONAWANDA, N. Y.

HOOKER CHEMICAL CORPORATION

HOOKER CHEMICALS PLASTICS

Gives high whiteness—with minimum loading

UNITANE® 0-220

TITANIUM DIOXIDE

Save – through minimum loading – with UNITANE 0-220, yet get maximum whiteness in the bargain! The high opacity and clear color tone of this pigment give it maximum whitening power; you load less, get better results!

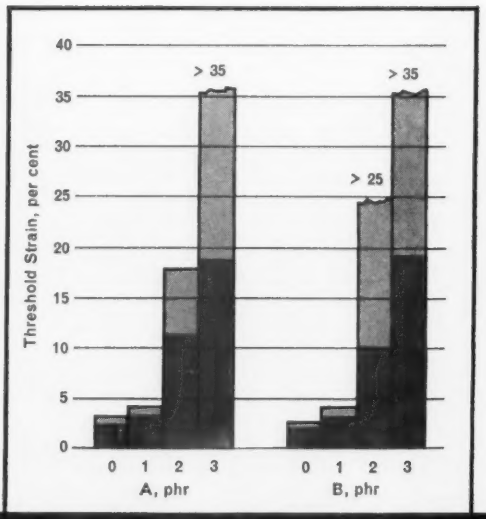
UNITANE 0-220 also eliminates some of the trouble spots in processing. It wets easily, is readily dispersible and is non-reactive with rubber chemicals. UNITANE 0-220 maintains its brilliancy throughout curing and aging, assuring a better-looking finished product with longer-lasting whiteness.

For economy, easier processing and product improvement, specify UNITANE 0-220. Just ask your Cyanamid Pigments representative for samples and full information.

CYANAMID

AMERICAN CYANAMID COMPANY
Pigments Division
30 Rockefeller Plaza, New York 20, N.Y.
Branch Offices and Warehouses in Principal Cities

how can rubber be best protected against SEVERE OZONE CONDITIONS?



severe conditions of ozone and stress call for extra-special protection . . .

Smog which may contain up to 100 pphm ozone is hard on health and disposition. It is equally hard on rubber products. High ozone levels cause severe cracking in rubber formulations. In addition, stress also contributes to this problem as shown in chart. How do you prevent such deterioration, assure long service life for your product under severest service conditions?

First, use antiozonants UOP 88 or 288, which offer maximum ozone protection. A relatively small loading of these low-cost antiozonants goes a long way in providing increased protection.

Ozone concentration is but one of many factors to consider in manufacturing antiozonant-containing rubber products. Our staff of specialists, backed by UOP laboratory facilities and field experience, will be happy to discuss your problems with you. Simply write or telephone our Products Department.

40 pphm ozone

120 pphm ozone

Chart above shows effects of increasing antiozonant content of SBR stocks to meet increasing ozone level.

UOP®

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

As Ken Soule Sees It

by Kenneth J. Soule

Aviators Par Excellence

A massive 250-page reference book published jointly November 18 by Doubleday and Co., and The Museum of Natural History, is receiving widespread attention in amounts which are unusual—and perhaps unique—in publishing annals. This is due to the multiplicity and diversity of potential reader interest.

The book in question is entitled, *Hummingbirds*. The author, Crawford H. Greenewalt, president of E. I. du Pont de Nemours and Co. The volume is the culmination of a spare-time hobby of Mr. Greenewalt—the deep and penetrating study of the world's hummingbirds. These fascinating creatures are found only in the Western Hemisphere, so the search and study has resulted in travels totaling over 100,000 miles through Brazil, Ecuador, Venezuela, Cuba, Jamaica and Panama, as well as Arizona, California and Colorado. The book reveals many facts hitherto unknown concerning the life and habits of the 319 species of hummingbirds living in North, Central, and South America. Incidentally, only twelve of these species live in the U. S. The book also contains seventy spectacularly beautiful full-color plates, showing many of the airworthy birds in mid-flight, or occasionally, at rest on a perch.

Obviously, such a volume will have great appeal to bird lovers—or more properly, ornithologists. However, as the pre-publication publicity in newspapers and magazines indicates, many other groups will find much of interest. A notice in *Chemical and Engineering News* (November 7) mentioned among other things, the "stroboscopic flash — one thirty-millionth of a second in duration," developed by Mr. Greenewalt and his associates. This made the high-speed photography possible. Another item of interest to scientists is the explanation of the "hummer's" brilliant coloring, which is due to a mechanical diffraction effect and not to pigmentation.

These and a host of other fascinating matters are covered in the Greenewalt book, and also in much less detail in a *National Geographic* article, by the same author, in the November, 1960 issue. This was published several weeks prior to November 18, the book publication date. The article contains 24 surpassingly beautiful, full-color pictures of hummingbirds, and recounts in detail the travels undertaken and some of the facts unearthed by the author. The writing style is simple and descriptive, yet uniquely his own. It is also precise and direct, as befits a one-time working chemist who is still a technical expert.

"Rubber people," and especially rubber chemists, know DuPont well as a major supplier of rubber chemicals and synthetic rubbers. It is no wonder then that they will feel a sense of pride that one of their number was able, for twelve years, to head up very successfully the world's largest chemical company, and in his spare time, (weekends, holidays, vacations, etc.), write such an outstanding work on such an involved subject!

Foot-Note: Beginning November 18, 1960, and continuing for four months—a special display of many of the Greenewalt color photos of hummingbirds, and a movie on the same subject, will be featured at—the American Museum of Natural History, in New York City.

Keep It Clean

Self-service laundries are big business in this country, having skyrocketed from about 4,000 in 1956, to over 25,000 in 1960. But the spread to self service dry cleaning is something quite new and novel in the do-it-yourself field.

The first of the major appliance manufacturers definitely to enter the new field is Norge Division of Borg-Warner. Others such as Whirlpool, General Electric, Westinghouse, etc., will no doubt soon follow suit. According to a recent article in *Chemical and Engineering News,* the first company to market a commercial coin-operated dry cleaning unit was Standard, Inc., a small Dallas, Texas, firm. Although they are said to have received a considerable number of orders, it is thought doubtful that they will ultimately be much of a factor in the business because of the relatively high price of their machine. It runs about $6,000 for a twin unit.

By comparison, Norge guarantees that their price for a bank of eight machines will not be over $15,000—and they hope to be able to reduce this preliminary figure.

All of the surveys made, as well as field experience to date, seem to indicate that the new coin-operated machine will find ready customer acceptance. No doubt the moderate charge of about $1.50, per eight-lb. load has a great deal to do with this feeling. It, of course, remains to be seen just how well the general public will be satisfied with the finished appearance of its dresses, suits and other articles of clothing as they come from the machine. The goods will no doubt be clean, but will they be wrinkle free and ready to wear? This is one of several imponderables, which only time can answer.

It is thought that the new units will first appear in volume as adjuncts to self-service laundries. Other

likely spots are said to be apartment houses, hospitals, college fraternity and sorority houses, etc.

In the event that even a sizeable portion of these dreams are realized, the market for the chemicals involved, will be more than trivial. For instance, at the present time it is said that about 12,000 commercial dry cleaners in this country use around 150 million pounds of perchlorethylene per year. (The other 22,000 commercial operators prefer to use petroleum based Stoddard Solvent.) The new do-it-yourself machines will all use a non-inflammable solvent such as perchlorethylene and will also require certain filter aids and detergents. How much this will boost the total consumption of such materials is another of the unanswered questions, since no one can be certain how much the self-service business will cut into that of established dry cleaners.

Life and Death

Rubber figured prominently in the news recently in a circumstance involving real, as well as potential tragedy. The quite unusual and sadly spectacular event took place in New York City on November 13. That evening two sadistic gunmen broke into an automobile showroom on 57th St., and locked a fifty-year-old night watchman, and a janitor, age thirty-six, in the trunks of two automobiles. When the men were discovered about six hours later, by next-shift employees, the elder man unfortunately was dead of "suffocation," but his partner was alive and well. In fact, the younger man had practically succeeded in battering his way out of the thirteen-cubic-foot space in which he had been imprisoned.

According to reports of police covering the incident, the reason why one man lived and the other did not, was that only one had the presence of mind to remember and make use of the spare tire. Here was a reservoir of fresh air, which provided life-giving oxygen as the air valve was periodically opened.

From a purely scientific angle, several things are of particular interest in this matter. First, it is quite amazing (to me at least) that the air in a spare tire would be adequate to sustain a man's life for about six hours in an air-tight enclosure. Particularly when the victim was under such severe mental and physical strain during the entire time. Second, I am frankly surprised that *any* automobile trunk is as completely and almost permanently air-tight as these seem to have been. Also, that it was not possible to wedge open one side of the trunk cover, with a tire iron, enough to admit at least a trickle of air between the gasket and the metal. Of course, the conditions encountered were most frightening, and action very restricted due to the cramped quarters. Still, it would seem that natural panic, or perhaps a heart attack, as well as the absence of oxygen may have been equally responsible for the casualty.

Finally — if it took an active, virile, anxious, young man almost six hours to force his way out of a trunk, using a car-jack and tire tools; car-bodies and workmanship must be better than is sometimes loudly alleged. In this connection, highly skilled auto mechanics tell me that they believe the incident mentioned above could have happened much as it did, regardless of which of the five or six leading makes of U.S. automobiles had been involved. However, for the sake of the record, it is no more than fair to state that both cars in question were 1960 Cadillacs.

Anchors Aweigh

For the past five years, a face-lifting, or more properly a complete rehabilitation job has been quietly but steadily going forward on one of America's most hallowed ladies. The *grand dame* in question is the first ship ever commissioned by the United States Navy — the sailing warship, the frigate "Constellation." She took to the water in 1797, soon to be followed by the frigates "Constitution," and "United States."

As detailed in a lead article by William G. Wing, in the *New York Herald Tribune*, of October 24, the "Constellation" had a long, valiant and fantastically varied career. In 1797, during a short-lived war with France, she captured the frigate "L'Insurgente"; in 1802, successfully engaged the Barbara pirates; and in 1812, defended Norfolk. She also served in the Mediterranean during the Civil War. Various peacetime missions included one to China in 1841 carrying the American ambassador who negotiated the Open Door Policy, and those to Ireland in 1880 bringing relief supplies to potato-famine sufferers there. Later she continued to serve as a training ship for several generations of naval officers. Coming up to more recent times, President Franklin Roosevelt convalesced on her decks from his crippling attack of polio. It is said that it was at FDR's insistence that the "Constellation" was made an auxiliary flagship of the Atlantic Fleet during World War II. In 1955 the ship was leased by the Navy to a private restoration committee of Baltimore, Md.

The current rehabilitation is a slow and painstaking effort, involving as it does the removal of unbelievable amounts of old wood and the meticulous substitution of new timbers. At present, one side of the vessel has been entirely replanked, while the other side is about half done. Decking, rigging, and interior wood work still remain to be finished.

Foamed with FREON®

FLEXIBLE URETHANE FOAMS

Bring lower production costs to you, superior quality to your customers

Reduced production costs. Du Pont "Freon", as an auxiliary blowing agent, now permits you to *control* the density of your flexible urethane foams. Result—you can produce a greater volume of urethane foam from the same amount of raw materials.

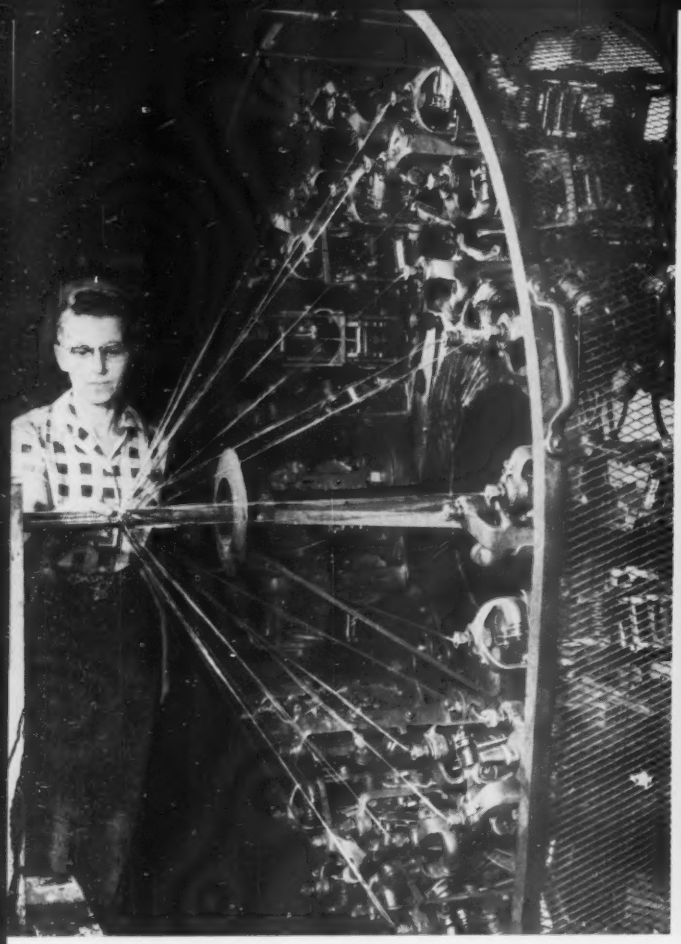
Improved foam quality. By controlling foam density, you can now provide customers with urethane foams that meet their cushioning needs more closely —foams that are softer and more resilient, foams that permit thinner cushioning. Yet you provide all of the other physical advantages of urethane foams to customers in the furniture, bedding, carpet and automotive industries.

For more information on how "Freon" blowing agents can help you produce greater volumes of higher-quality urethane foams, write: E. I. du Pont de Nemours & Co. (Inc.), "Freon" Products Division, N-2420, Wilmington 98, Delaware.

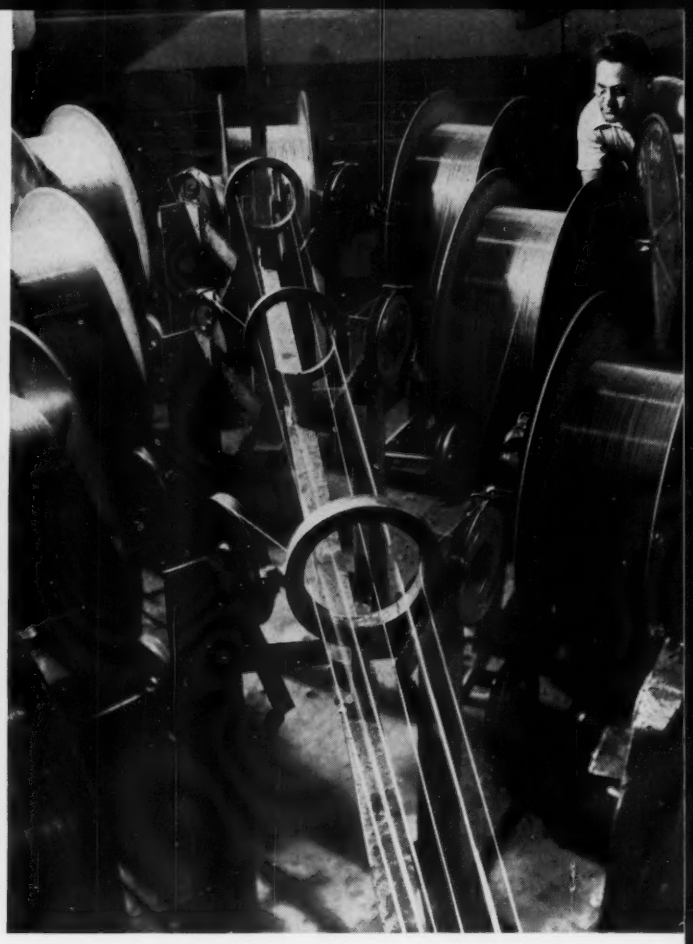
FREON®
BLOWING AGENTS

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY



B. F. Goodrich Company braids multiple strands of steel wire into intricate sinews around rubber tube to help control and resist tremendous internal pressures required of flexible hydraulic hose. Wire such as supplied by Johnson has tensile strengths ranging from 240,000 to 400,000 psi.



Firestone Tire and Rubber Company uses only high tensile steel wire of exacting tolerances in building tire beads. Rapidly entering the bead machine in parallel —three to fifteen wires wide, depending on strength specified—the wires are coated with rubber. Clean bronze finish on Johnson wire assures proper rubber adhesion.

The best names in rubber use Johnson wire for strength and safety in tires and hose

The rubber industry has a sound reputation for producing quality products in advance of its needs by use of imaginative research—painstaking development of production methods—careful selection and testing of component materials.

Goodyear—Firestone—U.S. Rubber—B. F. Goodrich—Thermoid and others have established their names over the years by giving the general public and industry alike—strength, safety and durability in products such as long lasting pneumatic tires and tough pressure hose.

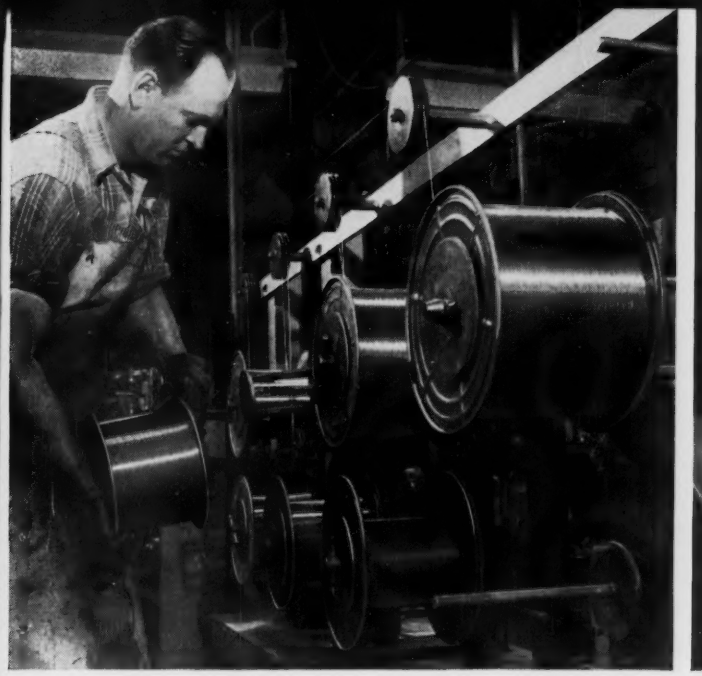
These two products owe their strength in part to the fine steel wires hidden inside them. For it is high-carbon steel bead wire which gives a pneumatic rubber tire—no matter what its size or job, the strength demanded by modern vehicles. Similar wire gives pressure hose its strong sinews which enable it to withstand working pressures as high as 10,000 psi—bursting strength may be three to four times as great.

Take the case of tire bead wire which Johnson supplies to every major tire manufacturer in the country. It is precision-drawn from special high-carbon rods to .037″ in diameter with a tolerance of only .002″—so fine that a 750-pound reel contains 39 miles of wire. Yet, a single strand exceeds 290 pounds of breaking strength equal to a tensile strength of 270,000 psi.

Also the wire must present a clean, unbroken surface and have a good and uniform bronze finish. This finish makes possible tight adhesion between the wire and the rubber surrounding it.

All these qualities contribute to the tire bead strength, help assure the safety of those who ride for work or pleasure on pneumatic tires.

Another special wire made by Johnson for the rubber industry helps rubber hose contain enormous pressures demanded by modern industrial applications. This reinforcing wire is drawn from selected high-



Thermoid Division, H. K. Porter Company, has cut wire rewind loss to ½ of 1% by use of Johnson Discard-a-Spool which eliminates overlaps and tangles, protects wire quality in shipment. The one-way disposable spool weighs only 28 ounces vs 200 ounces for standard spool—slashes tare weight 14 times.

United States Rubber Company wires tires for strength on this bead building machine. The strength comes from the steel wire bead in the edge of each tire. Johnson makes special high-carbon steel wire—.037″ in diameter with tolerance of only .002″ for U.S. and other major tire companies.

carbon steel in diameters ranging from .008″ to .020″ and has exceptional dimensional accuracy—tolerance is plus or minus .0005″.

Johnson hose reinforcement wire is supplied with a special liquor finish to provide maximum adhesion of steel to the rubber which fills the interstices between braids.

The wire is uniformly cast to make possible even spooling and has uniform tensile strength to prevent breaking under the working tension.

These excellent wire qualities, plus careful packaging and prompt delivery, have resulted in Johnson becoming a prime supplier to the rubber industry for hose reinforcement wire.

The outstanding performance of Johnson wire in the rubber industry is typical of the experience in other industries where Johnson supplies aircraft cord wire, armature binding wire, wire for brushes, metal stitching, preformed staple wire, bobby pin wire, rope wire, oil tempered and MB hard drawn spring wire, and music spring wire in a wide variety of sizes and finishes.

If you use specialty wires, call one of the offices listed to right and explore the advantages of Johnson quality which combines strength with economy.

The Goodyear Tire & Rubber Company finds that Johnson meets their exacting requirements for tire bead wire which has high tensile strength, twisting strength, elongation and special surface finish. Here parallel tire bead wires uncoil evenly into a bead building machine.

Johnson Steel & Wire Company, Inc.

Worcester 1, Massachusetts

a subsidiary of **Pittsburgh Steel Company**

Grant Building • Pittsburgh 30, Pa.

DISTRICT SALES OFFICES

Akron	Cleveland	Detroit	Los Angeles	Pittsburgh
Chicago	Dayton	Houston	New York	Tulsa
			Philadelphia	Warren, Ohio

we'll make the press

YOU NAME THE MATERIAL CHARACTERISTICS

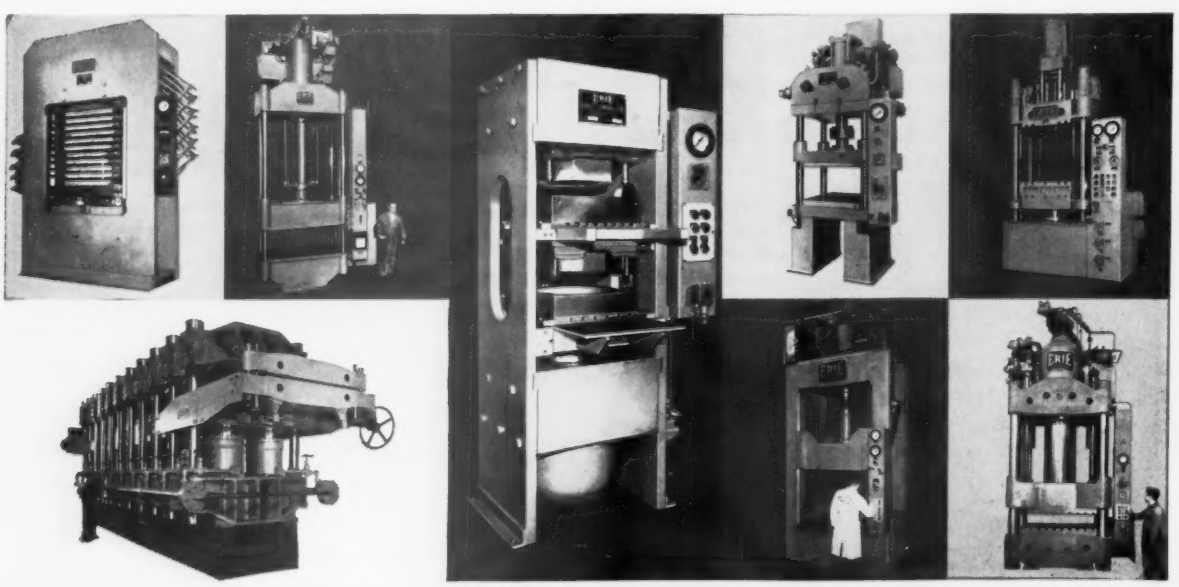
Just tell us the nature of the material—polyester, acrylic, fiber glass, rubber, or whatever—and give us your production specifications. We'll build the right compression molding press to meet your needs.

Erie Foundry regularly builds hydraulic molding presses in capacities of 25 to 4,000 tons. Our advanced design control systems will apply forces accurately and precisely, maintain platen temperatures within close tolerances, and perform molding cycles with split-second timing. Versatility is built in so that a wide range of molding jobs can be handled.

Write now for your copies of our descriptive bulletins on Erie Foundry hydraulic presses for rubber and plastics.

Hydraulic Press Division
ERIE FOUNDRY CO. ERIE 7, PA.

ERIE
THE GREATEST NAME IN FORGING . . . SINCE 1895



PHILBLACK* PRIMER

E is for Extra Endurance

(for heavy duty tires and
track-type tractor treads)

Philblack E puts "heart" in rubber! Helps to withstand the terrific punishment off-the-road tires and industrial belts have to take hour after hour, day after day.

Perhaps your rubber product does not need all the extra reinforcing strength that Philblack E imparts. Then tell your Phillips technical representative just what your requirements are. Let him advise you on your rubber recipes. He may help you save processing time . . . help prevent operational troubles . . . and *decrease your costs*, as well!

*A trademark

LET ALL THE PHILBLACKS WORK FOR YOU!

A — **Philblack A, Fast Extrusion Furnace Black.** Excellent tubing, molding, calendering, finish! Mixes easily. Disperses heat. Non-staining.

O — **Philblack O, High Abrasion Furnace Black.** For long, durable life. Good conductivity. Excellent flex life and hot tensile. Easy processing.

I — **Philblack I, Intermediate Super Abrasion Furnace Black.** Superior abrasion. More tread miles at moderate cost.

E — **Philblack E, Super Abrasion Furnace Black.** Toughest black yet! Extreme resistance to abrasion.

PHILLIPS 66

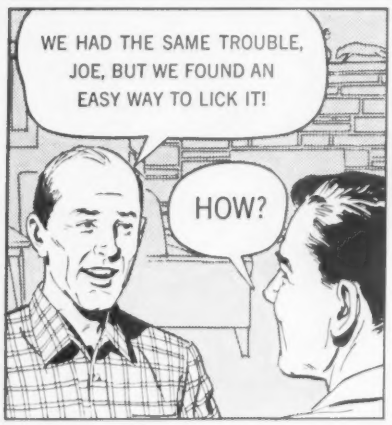
PHILLIPS CHEMICAL COMPANY

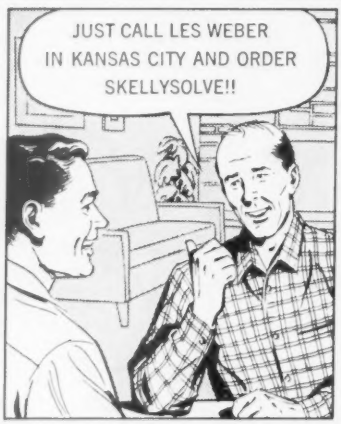
Rubber Chemicals Division, 318 Water St., Akron 8, Ohio

District Offices: Chicago, Dallas, Providence and Trenton • *West Coast:* Harwick Standard Chemical Company, Los Angeles, California

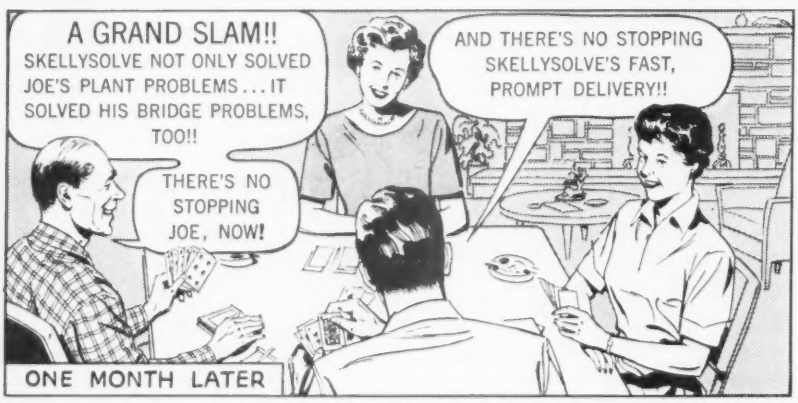
Export Sales: Phillips Petroleum International Corporation, Sumatrastrasse 27, Zurich 6, Switzerland
Distributors of Phillips Chemical Company Products, 80 Broadway, New York 5, N.Y.

A
THE CASE OF THE
SIX SPADES
WOW! WE MADE SIX SPADES!
JOE! THAT'S ANOTHER HAND YOU'VE JUST GIVEN AWAY! WHAT'S WRONG?
SORRY. I JUST CAN'T CONCENTRATE. WE'RE HAVING LATE DELIVERIES AT THE PLANT AGAIN, AND EVERYONE'S ON MY NECK!

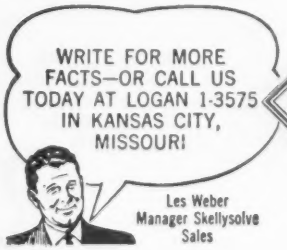




NINE OUT OF TEN CARS ARE SHIPPED THE DAY AFTER THE ORDER IS RECEIVED... AND SKELLYSOLVE'S TECHNICAL SERVICE IS BACKED BY OVER 30 YEARS OF EXPERIENCE!
THANKS FOR THE TIP!


A GRAND SLAM!!
SKELLYSOLVE NOT ONLY SOLVED JOE'S PLANT PROBLEMS... IT SOLVED HIS BRIDGE PROBLEMS, TOO!!
THERE'S NO STOPPING JOE, NOW!
AND THERE'S NO STOPPING SKELLYSOLVE'S FAST, PROMPT DELIVERY!!
ONE MONTH LATER

Many companies in your industry depend on Skellysolve for exacting quality, prompt shipment, and uncontaminated products. For complete facts contact us at LOgan 1-3575, Kansas City, Mo.



SKELLY

Skellysolve

SKELLY OIL COMPANY

Marketing Headquarters, Kansas City 41, Mo.

Skellysolve for Rubber and Related Industries

SKELLYSOLVE-B. For making quick-setting cements for the shoe, tape, container, tire and other industries. Quick-drying, with no foreign taste or odor, in dried compound. Closed cup flash point about −25° F.

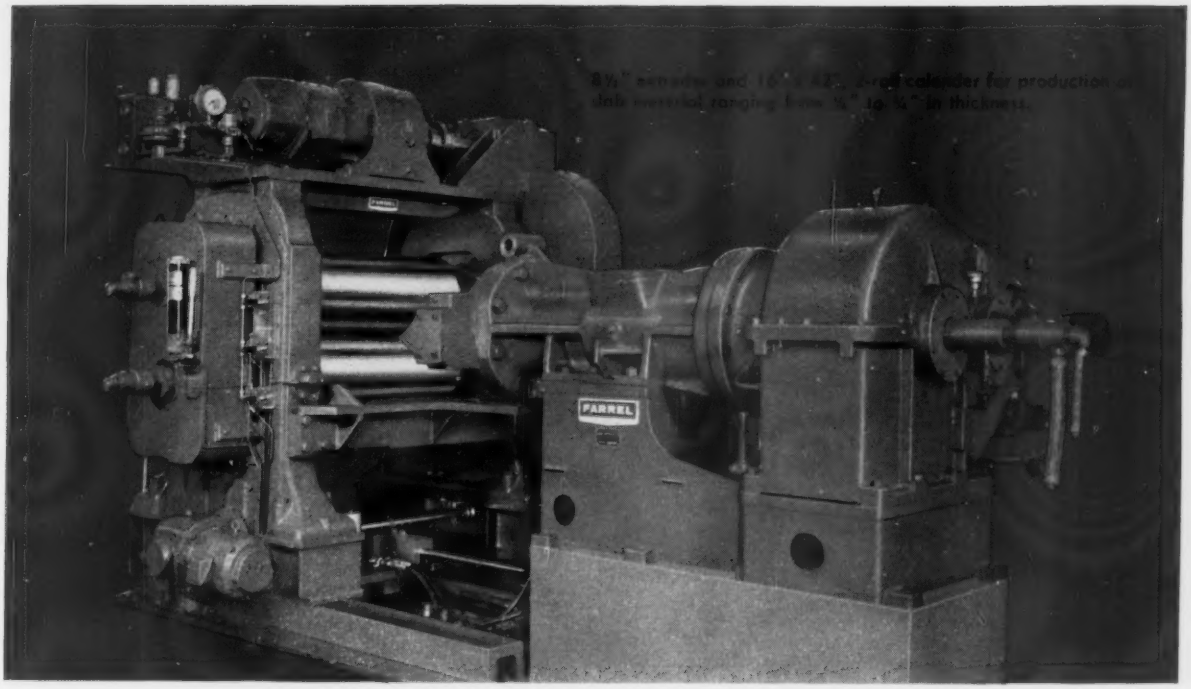
SKELLYSOLVE-C. For making quick-setting cements with a somewhat slower drying rate than those compounded with Skellysolve-B. Closed cup flash point about 13° F.

SKELLYSOLVE-H. For general use in manufacturing operations and cements, where faster evaporation rate than that of Skellysolve-C is desired. Closed cup flash point about −16° F.

SKELLYSOLVE-L. For general manufacturing operations where a medium evaporation rate is required. Closed cup flash point about 12° F.

SKELLYSOLVE-R. For general use in tire building and a variety of other manufacturing operations and cements. Reduces evaporation losses. Medium quick final dry. Lessens bloating and skinning tendency. Closed cup flash point about −25° F.

Ask about our Skelly Petroleum Insoluble Grease



NEW ROLLER-HEAD EXTRUDER

produces heavy-gauge sheet stock free of blisters and scorching

Typical of the specialized machines built by Farrel-Birmingham is this newly-designed extruder-calender combination. Used in the production of slab material, such as rubber sole and heel stock, it consists of an 8½" extruder with a slot head that feeds directly into the bank of a 16" x 42" two-roll calender.

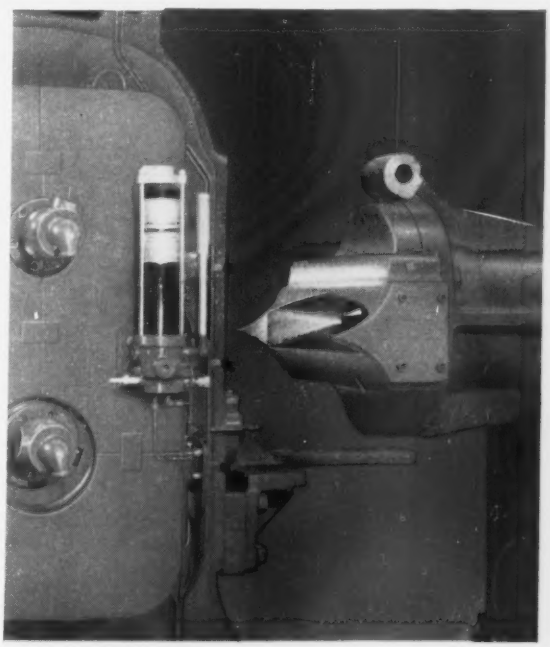
The first few installations of this unit have been highly successful. Gone are the back flow and resultant increased stock temperatures associated with conventional machines used in this type of extrusion. The Farrel unit features a roller-head die or calender rolls, which can be cooled as required. Pulling action of the rolls and minimum restriction offered by the extruder die also reduce heat build-up within the stock.

The calender, which has a crossed-axes device for close gauge control, moves to and from the extruder on a sliding base. To increase the versatility of the combination, both the calender and extruder have adjustable-speed drives.

Ask for quotations on special extruders to meet your requirements.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia, and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, Akron, Chicago, Los Angeles, Houston, Atlanta
European Office: Piazza della Republica 32, Milano, Italy



Close-up of the extruder head which feeds directly into the bite of the rolls.

FARREL

FB-1200

coming events

1960

Dec. 16. Boston Rubber Group, Christmas Party, Somerset Hotel, Boston, Mass.

Dec. 16. Chicago Rubber Group, Christmas Party, Morrison Hotel, Chicago, Ill.

Dec. 16. New York Rubber Group, Christmas Party, Henry Hudson Hotel, New York, N. Y.

Dec. 26-31. American Association for the Advancement of Science, Annual Meeting, New York, N. Y.

Dec. 29-30. Division of Industrial and Engineering Chemistry, American Chemical Society, 27th Annual Chemical Engineering Symposium, Washington University, St. Louis, Mo.

1961

Jan. 6. Akron Polymer Lectures, "Application of Differential Thermal Analysis to High Polymers," University of Akron, Akron, Ohio.

Jan. 9-11. National Symposium on Reliability and Quality Control, Bellevue Stratford Hotel, Philadelphia, Penna.

Jan. 9-13. Society of Automotive Engineers, International Congress and Exposition of Automotive Engineering, Convention Center, Detroit, Mich.

Jan. 10. Ontario Rubber Group, Technical Meeting, Clover Leaf Hotel, Toronto, Ontario, Canada.

Jan. 16-19. Instrument Society of America, Winter Instrument-Automation Exhibit, Sheraton Jefferson Hotel and Kiel Auditorium, St. Louis, Mo.

Jan. 19. Quebec Rubber & Plastics Group, Technical Meeting.

Jan. 20-21. Southern Rubber Group, Statler Hilton Hotel, Dallas, Texas.

Jan. 24-27. Society of Plastics Engineers, 17th Annual Technical Conference, Shoreham and Sheraton Park Hotels, Washington, D. C.

Jan. 26. Tire Retreading Institute, Administrative Committee Meeting, Seville Hotel, Miami, Fla.

Jan. 26-27. Engineering Institutes on Nondestructive Testing, University of Wisconsin, Madison, Wisc.

Jan. 27. Akron Rubber Group, Technical Meeting, Sheraton Hotel, Akron, Ohio.

Jan. 27. Chicago Rubber Group, Technical Meeting, Furniture Club, Chicago, Ill.

Jan. 27-28. National Tire Dealers & Retreaders Association, Executive Committee Meeting, Seville Hotel, Miami, Fla.

Jan. 28-Feb. 1. National Automobile Dealers Association, 44th Annual Convention, San Francisco, Calif.

Jan. 30-Feb. 3. American Society for Testing Materials, Committee Week, Netherland Hilton Hotel, Cincinnati, Ohio.

Jan. 30-Feb. 2. Plant Maintenance and Engineering Show, International Amphitheatre, Chicago, Ill.

Feb. 1-3. Committee D-11 on Rubber and Rubber-Like Materials, ASTM, Netherland Hilton Hotel, Cincinnati, Ohio.

Feb. 3. Akron Polymer Lectures, "Some Aspects of Anionic Polymerizations," University of Akron, Akron, Ohio.

Feb. 3-5. Boston Rubber Group, Ski Weekend.

Feb. 7. Los Angeles Rubber Group, Technical Meeting, Biltmore Hotel, Los Angeles, Calif.

Feb. 7-9. Society of the Plastics Industry, 16th Reinforced Plastics Division Conference, Edgewater Beach Hotel, Chicago, Ill.

Feb. 7-9. Textile Technical Federation of Canada and Primary Textile Institute, 2nd Canadian Textile Conference, Queen Elizabeth Hotel, Montreal, Quebec, Canada.

Feb. 8. American Association for Textile Technology, Annual Meeting, Hotel Commodore, New York, N. Y.

Feb. 9. Fort Wayne Rubber & Plastics Group, Technical Meeting, Van Orman Hotel, Fort Wayne, Ind.

Feb. 16-19. International Automotive Service Industries Show, co-sponsored by Automotive Service Industries Association and Motor & Equipment Manufacturers Association, Los Angeles, Calif.

Feb. 20-22. National Tire Dealers & Retreaders Association, Suppliers and Exhibitors Meeting, Sheraton Cleveland Hotel, Cleveland, Ohio.

Feb. 22-24. Material Handling Institute, Pacific Coast Show, Cow Palace, San Francisco, Calif.

Feb. 23-24. Protective Coatings Division, Chemical Institute of Canada, Divisional Conference, Toronto, Ontario, Canada.

Feb. 24. Quebec Rubber & Plastics Group, Ladies' Night, Victoria Hall, Montreal, Quebec, Canada.

Feb. 26-March 2. American Institute of Chemical Engineers, National Meeting, New Orleans, La.

March 3. Akron Polymer Lectures, "Thermal Decomposition of Unsaturated Materials," University of Akron, Akron, Ohio.

March 5-9. American Society of Mechanical Engineers, Aviation Conference, Statler Hilton Hotel, Washington, D. C.

March 10. Chicago Rubber Group, Technical Meeting, Furniture Club, Chicago, Ill.

March 14. Ontario Rubber Group, Joint Meeting with Wellington-Waterloo Section, Chemical Institute of Canada, Walper Hotel, Kitchener, Ontario, Canada.

March 16-17. American Society of Mechanical Engineers, Textile Engineering Conference, Clemson College, Clemson, S. C.

March 17. Boston Rubber Group, Spring Meeting, Somerset Hotel, Boston, Mass.

March 21-23. American Physical Society, High Polymer Physics Division, 21st Annual Meeting, Monterey, Calif.

March 21-30. American Chemical Society, 139th National Meeting, St. Louis, Mo.

March 23. Quebec Rubber & Plastics Group, Technical Meeting, Montreal, Quebec, Canada.

March 24. New York Rubber Group, Spring Meeting, New York, N. Y.

April 18-21. Division of Rubber Chemistry, American Chemical Society, Spring Meeting, Brown Hotel, Louisville, Ky.

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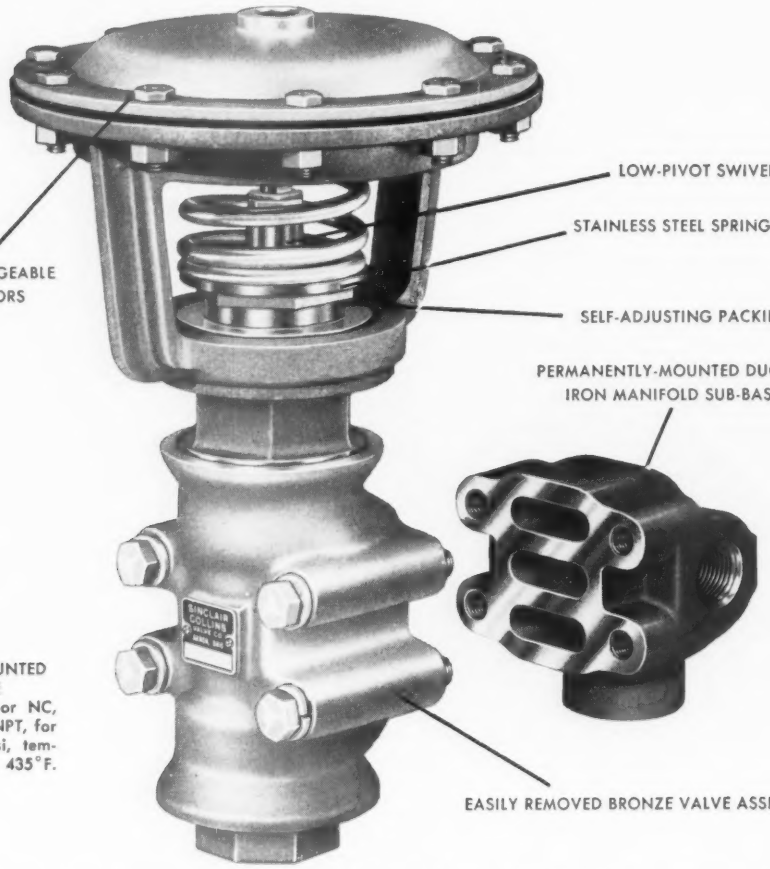

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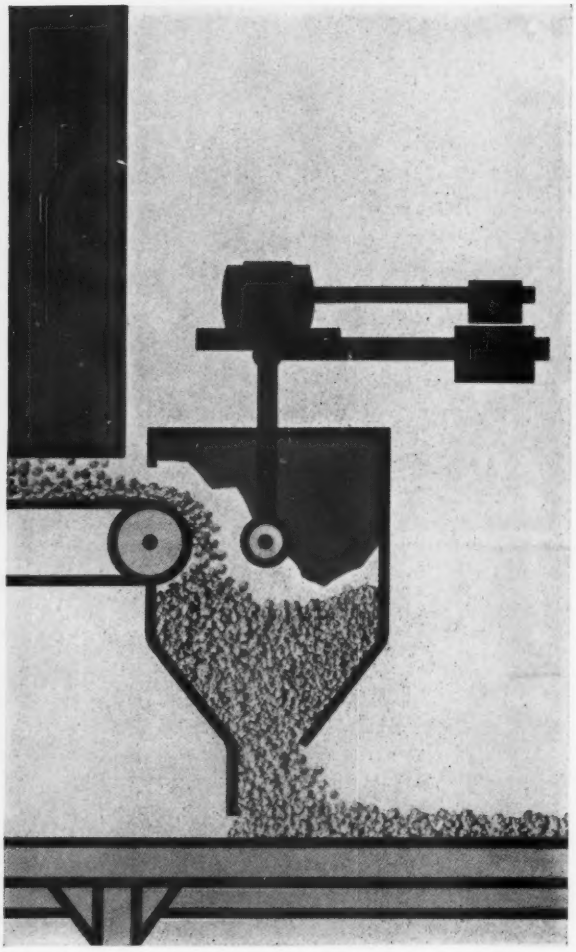

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Cast Urethane Elastomers From Polypropylene Glycols

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THE development of liquid urethane casting elastomers in recent years has provided the rubber technologist with polymers that can be varied greatly in chemical composition, and hence in their useful properties. In addition, potential savings in fabrication costs are possible, due to the ability to compound and mold them in a fluid, rather than solid state.

Liquid urethane elastomers based on polyesters, and their processing techniques, were previously described by various investigators *(1* through *4)*. The excellent low-temperature and aging properties of polyether urethanes, combined with their lower viscosity and lower costs, make them logical candidates for this application. These same properties proved very valuable in their rapid commercial acceptance in flexible foams. A polyether system which has been extensively studied is a reaction product of polytetramethylene glycol and tolylene diisocyanate, known commercially as Adiprene L *(5* through *10)*. Their vulcanizates have unusually high abrasion resistance compared to other elastomers of similar hardness, high strength, good low temperature properties and good chemical resistance.

Homo- and copolymers of polyethylene-, polypropylene- and polytetramethylene glycols were employed by Dickinson *(11)* in urethane casting polymers. This investigation showed that polytetramethylene glycols and blends of these with polypropylene glycols imparted better low temperature properties to the polymers than did polyethylene glycols.

This paper deals specifically with urethane elastomers cast from liquid prepolymers based on polypropylene glycols and tolylene diisocyanate. The influence of variations in these prepolymers on properties of the resulting elastomers was studied. Molecular weight of the polypropylene glycol used in the prepolymer preparation was varied over a molecular weight range of approximately 400 to 2000. Individual diols were compared with those containing blends of polypropylene glycols of the same average molecular weight. Blends of polypropylene glycol of 2000 molecular weight with other polyols, such as the polypropylene oxide adduct of trimethylolpropane of 450 molecular weight, castor oil and hydrogenated Bisphenol A were also prepared and tested.

Using polypropylene glycol of 2000 molecular weight as the sole polyether diol, a statistically de-

signed study was made of other variables in the preparation of liquid casting prepolymers. Included were the NCO/OH ratio, the tolylene diisocyanate isomer ratio, and the reaction temperature and time employed in prepolymer preparation.

For the chain extension and curing of the liquid prepolymers three different types of curing systems were used. The first, 4,4′-methylene-bis (2-chloroaniline) is representative of an aromatic diamine cure, and has been widely used because it provides adequate pot life and resulting polymers have comparatively good properties *(5* through *10)*. Chain extension takes place through the reaction of diamine with the isocyanate end groups of the prepolymer to form urea groups. The amount of diamine used in the chain extension appears to control the degree of cross-linking, since it is assumed that excess isocyanate will react with the urethane-urea polymer to preferentially form substituted biuret cross-links.

The second type of curing agent employed in this investigation is represented by polyols such as castor oil, and a propylene oxide adduct of trimethylolpropane of 450 molecular weight. In this case, chain extension takes place through the formation of urethane groups, which show a lesser degree of interchain attraction than urea groups.

The third type of curing system is represented by mixtures of diamine and polyol curing agents, providing a combination of desirable properties.

Preparation of Polymers

The polyols used in the preparation of prepolymers were stripped of water under a vacuum of 3 mm. of mercury and 120°C. maximum temperature. The polyols were then cooled below 50°C. and the tolylene diisocyanate added with stirring. The reaction mixtures were heated for three hours at 80°C. under constant agitation. After the reactions were completed, the prepolymers were aged for two days at room temperature. The free isocyanate content and viscosity were then determined. The prepolymers prepared for this investigation are shown in Table I.

In one set of statistically designed experiments, the NCO/OH ratio, the isomer ratio of tolylene diisocyanate, and the reaction time and temperature were varied. Table II lists a schedule of formulating and processing of these prepolymers.

Preparation of Elastomers

Weighed amounts of the liquid prepolymers in 4 ounce capped bottles were heated in a 100°C. air-circulating oven for 15 minutes. The tops were then removed, and the prepolymers degassed in a vacuum oven at 100°C. for 15 minutes.

Then the curing agent was stirred into the hot prepolymer and mixing continued until homogeneity was insured. The prepolymer-curing agent mixture was poured into molds, degassed, and cured in an air-circulating oven. Degassing was accomplished in a vacuum oven by lowering the pressure rapidly to 3 mm. mercury and then immediately raising it back to atmospheric pressure.

TABLE I—URETHANE CASTING PREPOLYMERS

Ratio of NCO:OH is 2:1 (2,4-TDI)

Polyols	Average Mol. Wt.	Viscosity Cps. (25°C.)	Free NCO %
PPG[1] 2000	2,000	4,100	3.4
PPG 1575	1,575	6,450	4.1
PPG 1280	1,280	8,500	4.8
PPG 1150	1,150	9,700	5.5
PPG 1000	1,000	12,600	6.2
PPG 775	775	26,400	7.5
PPG 400	400	500,000	10.5
PPG 2000 + PPG 1000	1,750	5,000	3.8
PPG 2000 + PPG 1000	1,500	6,500	4.3
PPG 2000 + PPG 1000	1,250	9,400	4.9
PPG 2000 + PPG 400	1,750	5,300	3.7
PPG 2000 + PPG 400	1,500	6,500	4.4
PPG 2000 + PPG 400	1,250	8,600	5.0
PPG 2000 + PPG 400	1,000	16,100	6.0
PPG 2000 + Hydrog. Bisphenol A	1,250	19,900	5.3
PPG 2000 + DB Castor Oil	1,250	13,000	5.0
PPG 2000 + Triol[2] 450	1,250	15,200	4.9

(1) Polypropylene Glycol
(2) Polypropylene oxide adduct of trimethylolpropane

Curing Systems

Diamine. DuPont's MOCA, 4,4′-methylene-bis (2-chloroaniline), was the diamine used for the major portion of the work described in this paper. The amount of MOCA used in the curing process was selected to yield a theoretical molecular weight of 6850 per biuret cross-link in the polymer. A method for calculating the molecular weight per cross-link for urethane polymers has been given by Sandridge *et al (13)*. These elastomers were cured for three hours at 100°C. In one set of experiments, the MOCA extended elastomers were cured either four hours at 100°C., two hours at 120°C., or one hour at 140C°.

Polyols. The polyols used as sole curing agents were Triol 450 (polypropylene oxide adduct of trimethylolpropane of 450 molecular weight) and DB Castor Oil made by Baker Castor Oil Company. An equivalent amount of polyol curing agent was added to react with all the free isocyanate of the prepolymer. The resulting elastomers were cured at 140°C. for three hours.

Diamine-Polyol Blends. Blends of MOCA-Triol 450 and MOCA-DB Castor Oil were employed as curing agents. A theoretical molecular weight of 6850 per biuret cross-link was also used for the MOCA-polyol

Effect of Molecular Weight of Polyether Glycols on Elastomer Properties

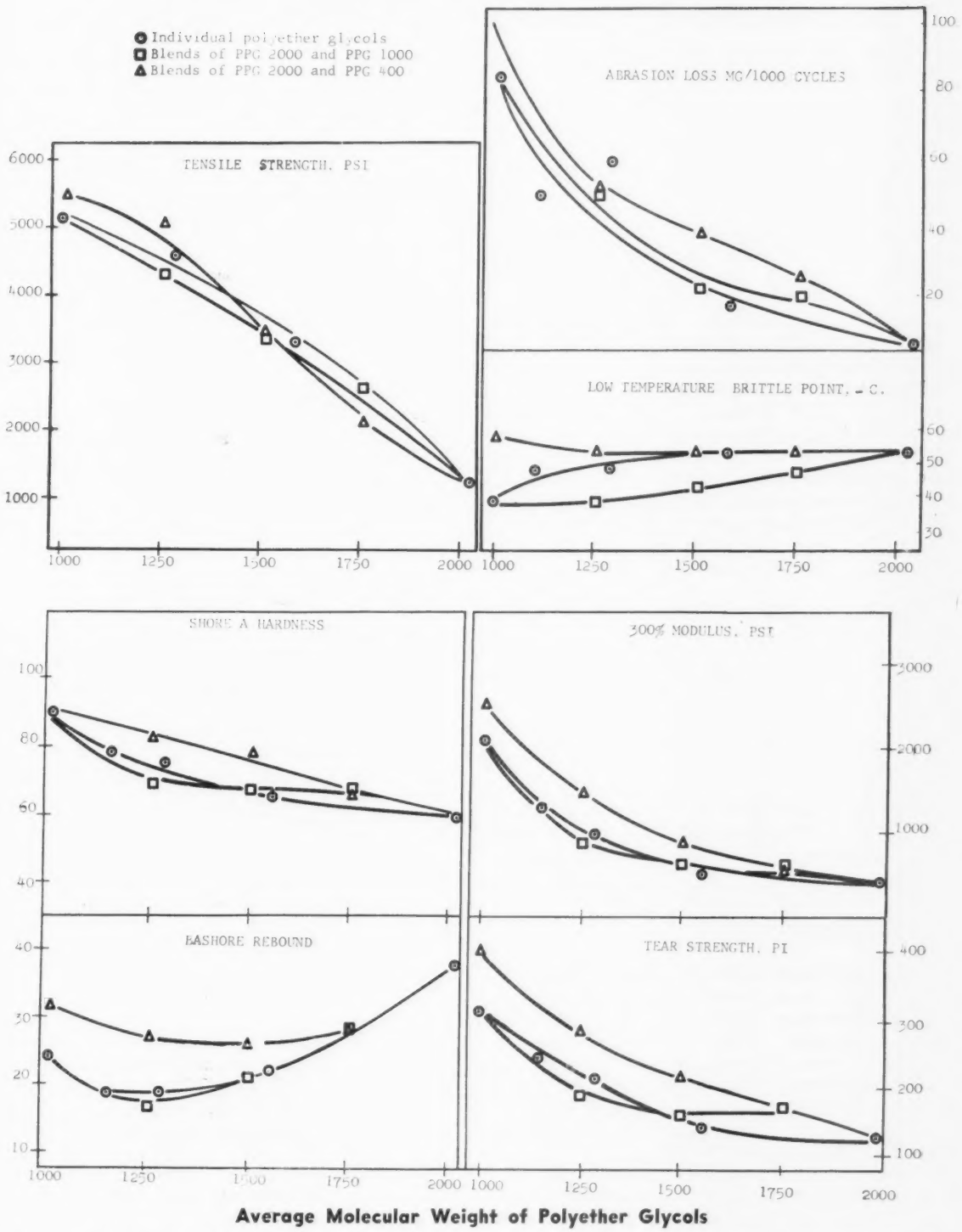
Individual polyether glycols
Blends of PPG 2000 and PPG 1000
Blends of PPG 2000 and PPG 400
TENSILE STRENGTH, PSI
ABRASION LOSS MG/1000 CYCLES
LOW TEMPERATURE BRITTLE POINT, - C.
SHORE A HARDNESS
300% MODULUS, PSI
BASHORE REBOUND
TEAR STRENGTH, PI
Average Molecular Weight of Polyether Glycols

FIG. 1—Average molecular weight of polyether glycols is shown as the abscissa plotted against various ordinates: tensile strength, abrasion loss, low temperature brittle point, Shore A hardness, Bashore rebound, 300% modulus, and tear strength.

curing systems. Additional cross-links were formed due to the trifunctionality of the curing polyols. These elastomers were cured at 122°C. for three hours.

Test Methods

All test specimens were conditioned at least two weeks at room temperature prior to testing.

Stress-Strain Properties. A modification of ASTM Method D412-51T was used for measurement of the stress-strain properties. Tensile strength, elongation at break and stress at 300 per cent elongation were determined. The tensile sample dimensions were somewhat smaller than those given in the ASTM specifications. The width was ⅛ inch and the initial jaw separation was ¾ inch. An Instron Tester Model TTC-M1 was used; the testing speed was 20 inches a minute.

Graves Tear. This test was run on the Instron Machine according to ASTM Method D624-54, using Die C and unnicked 90 degree angle specimens.

Compression Set. The test used was a modification of ASTM D395-55 Method B. The samples varied in Shore A hardness from 55 to 99. However, only 25 per cent deflection of the original thickness was used throughout. The test was run on half-inch discs.

Shore A Hardness. The hardness was determined with a Shore A type Durometer according to a modification of ASTM D676-58T. Measurements were made 5 seconds after contact of the indentor with the half-inch disc specimens.

Moisture Absorption. A modification of ASTM Method D570-57T, Procedure A, was used. The specimens were conditioned by drying for one hour at 100°C. and 3 mm. mercury in a vacuum oven, prior to immersion in 23°C. water for 24 hours.

Abrasion Resistance. A Taber Abraser, Model 140PT, was used with 500 gram loads and H18 calibrade wheels. The tests were each run for 1,000 revolutions.

Low Temperature Brittleness. This test was run according to ASTM Method D746-57T using a Tinius Olsen brittleness tester. The heat transfer medium was air.

Results and Discussion

Effect of Average Molecular Weight of Polyether. The effect of average molecular weight of polypropylene glycol (hereafter referred to as PPG) on the properties of MOCA cured vulcanizates is shown in Figure 1. Included here is the comparison of the individual polyether glycols versus blends of PPG of 2,000 molecular weight with PPG 400 and 1,000 molecular weights, respectively. As the molecular weight decreased, tensile strength, tear strength, 300 per cent modulus, and hardness increased while abrasion resistance decreased. The embrittlement temperature increased slightly, with the exception of the PPG 2000/400 blends which remained essentially unchanged. Bashore Rebound exhibited a minimum in the 1250 molecular weight range.

It is interesting to note that the values for polymers containing blends of 2,000 and 1,000 molecular weight PPG resembled closely those of the individual diols. On the other hand, polymers containing blends of 2,000 and 400 molecular weight PPG exhibited almost consistently higher values with exception of the tensile strength and abrasion resistance.

TABLE II—URETHANE CASTING PREPOLYMERS FOR STATISTICALLY DESIGNED STUDY

PPG 2000-TDI Prepolymers

NCO/OH Ratio	% 2,4-Isomer in 2,4/2,6 TDI	Reaction Conditions[1]	% Free Isocyanate	Viscosity Cps.(25°C.)
2.0	100	A	3.3	4,150
2.5	100	B	4.5	4,910
2.0	100	C	2.8	11,200
2.5	100	D	4.4	5,000
2.5	80	A	4.9	2,860
2.0	80	B	3.0	8,550
2.5	80	C	4.2	6,760
2.0	80	D	3.0	5,080

(1) Reaction Conditions:
(A) 3 hours at 80°C.
(B) 3 hours at 80°C. + 2 hours at 140°C.
(C) 3 hours at 80°C. + 2 hours at 140°C. + 2 hours at 160°C.
(D) 2 hours at 140°C.

Variations in Prepolymer Preparation

Table III shows a comparison of elastomers prepared from blends of PPG 2,000 with lower molecular weight PPGs as well as with other polyols. Equivalent weight of these blends was selected as 625 and data for a PPG of 1,280 molecular weight was included for comparison. It is significant that the tensile strength and elongation were lower for polyol blends containing triols (Triol 450 and castor oil) than for diol blends. The modulus for the triols and hydrogenated Bisphenol A containing blends was considerably higher than for the polypropylene glycol polymers. This can be explained by the branched nature of the triols and by the cyclic structure of hydrogenated Bisphenol A. As expected, the compression set of the triol containing blends was lower than for the diol blends. It is interesting to note that the castor oil containing polymer had unusually low moisture absorption.

Effect of NCO/OH Ratio. The influence of the NCO/OH ratio used in preparation of the prepolymer on the properties of the MOCA cured elastomers is shown in Figures 2 and 3. As the NCO/OH ratio was increased, the tensile strength, tear strength, modulus and hardness increased; the compression set likewise exhibited marked improvement. However, the abrasion loss increased and the pot life decreased with increasing NCO/OH ratio. It is interesting to note that the Bashore Rebound did not appreciably change as the NCO/OH ratio was increased.

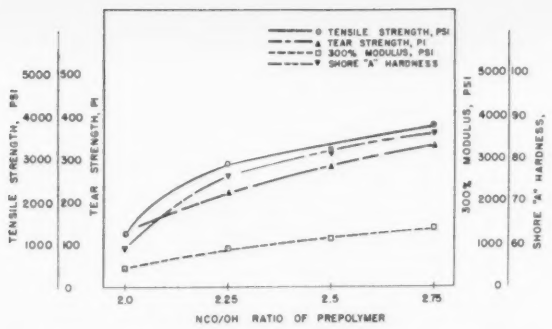

FIG. 2—Effect of NCO/OH ratio of prepolymer on elastomer properties (PPG-2000-2,4 TDI-MOCA).

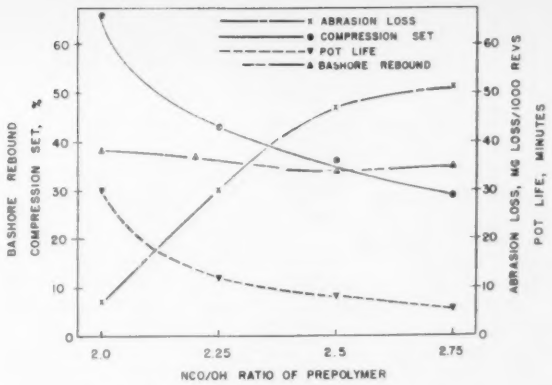

FIG. 3—Effect of NCO/OH ratio of prepolymer on elastomer properties (PPG-2000-2,4 TDI-MOCA).

Confirmation of the above trends for NCO/OH variations was obtained in each instance by a statistically designed set of experiments. Table IV lists the prepolymer variables and properties of the resulting elastomers.

Effect of Isomer Ratio in Tolylene Diisocyanate. The effect of using an 80/20 mixture of the 2,4 and 2,6 isomers in TDI versus the 100 per cent 2,4 isomer in the prepolymer preparation is also shown in Table IV. The use of the mixed isomers (80/20) resulted in a marked improvement in modulus, tear strength, Bashore Rebound, and hardness, and a moderate improvement in tensile strength. Concurrently, it caused a marked loss in abrasion resistance and pot life. No effect on compression set was observed.

Effect of Reaction Temperature and Time. As part of the statistical study, the heating cycle in the prepolymer preparation was varied as outlined in Table II. The effect of variations in reaction temperature and time on the properties of the resulting MOCA cured elastomers is shown in Table IV. Heating cycle B (3 hours at 80°C. + 2 hours at 140°C.), as compared to (A 3 hours at 80°C.), resulted in small losses in tensile strength, tear strength, Bashore rebound and pot life. However, these effects were partially or completely offset by a marked reduction in compression set.

Heating cycle C (3 hours at 80°C. + 2 hours at 140°C. + 2 hours at 160°C.) led to a marked loss in practically all properties with no compensating factor to warrant its further consideration. Heating

TABLE III—PROPERTIES OF MOCA CURED POLYMERS CONTAINING POLYOL BLENDS OF 625 EQUIVALENT WEIGHT

Polyol Blends of PPG 2000 + :	PPG 1000	PPG 400	Triol 450	Castor Oil	Hydrog. Bisphenol A	PPG 1280[1]
Pot life at 100°C. (minutes)	19	12	12	11	13	23
Original Polymer Properties						
Stress-Strain properties						
Tensile strength (psi)	4300	5065	3450	2920	4840	4585
Elongation (per cent)	860	625	430	290	650	840
300% modulus (psi)	900	1430	2155	1920	2000	970
Taber abrasion, H18 wheel Mg. loss/1000 cycles	50	51	109	83	92	60
Graves tear (pi)	185	285	181	230	355	210
Shore A hardness	69	82	76	74	89	75
Bashore rebound	17	27	23	25	29	19
Environmental Properties						
Compression set, 22 hrs. at 158°F., 25% deflection	60	60	34	23	77	62
Moisture absorption (per cent)	3.5	3.1	3.1	1.6	2.3	3.2
Tinius Olsen brittle point (degrees C.)	–45	–55	–55	–55	–45	–50

(1) PPG 1280 was the sole prepolymer polyol

TABLE IV—EFFECT OF PREPOLYMER VARIABLES ON PROPERTIES OF MOCA CURED PPG 2000-TDI ELASTOMERS

	NCO/OH Ratio		2,4-TDI Isomer		Prepolymer Reaction Time and Temperature[1]			
	2.5	2.0	100%	80%	A	B	C	D
Pot life at 100°C. (minutes)	12	25	27	10	19	14	24	16
Tensile strength (psi)	2570	960	1610	1930	2070	1820	1570	1600
300% modulus (psi)	1000	420	600	825	780	750	640	680
Taber abrasion, H18 wheel Mg. loss/1000 cycles	48	17	27	38	31	31	41	28
Graves tear, (pi)	197	120	131	187	188	160	129	159
Shore A hardness	71	50	54	66	64	62	51	64
Bashore rebound	29	33	27	34	33	31	28	32
Compression set, 22 hrs. at 158°F., 25% deflection	19	25	21	22	28	19	22	18

Values listed in the table were obtained by averaging across the levels of the other variables.

(1) Prepolymer Reaction Time and Temperature
A: 3 hours at 80° C.
B: 3 hours at 80°C. + 2 hours at 140°C.
C: 3 hours at 80°C. + 2 hours at 140°C. + 2 hours at 160°C.
D: 2 hours at 140°C.

cycle D (2 hours at 140°C.) gave slightly lower values than B in tensile strength and modulus, but was essentially equal otherwise.

Variations in Elastomer Preparation

Diamines. The reaction of the terminal isocyanate groups of the prepolymers with diamines yield substituted urea linkages which exhibit strong interchain attraction and contribute greatly to the high mechanical strength and temperature properties of the resulting elastomers.

MOCA cured elastomers are discussed extensively in the section on prepolymer variations. These provide desirable combinations of processing characteristics and properties.

Polyols. Prepolymers made from PPG 1,000, 775 and 400 molecular weight and 2,4 TDI at an NCO/OH ratio of 2:1 were cured with polyols such as castor oil, Triol 450, and combinations of Triol 450 with various diols. Since this phase of the work was of a preliminary nature, no tables or figures are shown. The polyol cured vulcanizates ranged in Shore A hardness from 30 to 70, tensile strength up to 2,500 psi and 300 per cent modulus up to 1,100 psi. Polyol cured elastomers exhibited excellent compression set and were light colored.

MOCA-Polyol Combinations. Elastomers were prepared from a PPG 775-2,4 TDI prepolymer (2

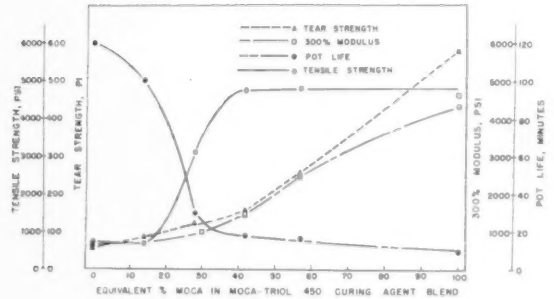

FIG. 4—Effect of MOCA-Triol 450 curing agent blends on PPG 775-2,4 TDI elastomer properties.

TABLE V—MOCA-POLYOL CURED ELASTOMERS VARIATION OF MOCA-CASTOR OIL RATIO USING PPG 400 PREPOLYMER

Equivalent per cent of MOCA in MOCA-castor oil curing system	50	33	0
Molecular weight/cross-link	3940	3200	2200
Pot life, minutes at 100°C.	20	25	70
Original Polymer Properties			
Stress-Strain properties			
Tensile strength (psi)	4715	4450	800
Elongation (per cent)	245	300	350
300% modulus (psi)		4450	620
Graves tear (pi)		310	70
Shore A hardness	100	97	50
Shore D hardness	65		
Bashore rebound	34	30	12
Environmental Properties			
Compression set, 22 hrs. at 158°F., 25% Deflection	12	6	3
Moisture absorption (per cent)		1.5	0.9

NCO/OH) cured with blends of MOCA and Triol 450. Some of the effects of increasing the MOCA concentration in MOCA-Triol 450 curing agent blends are shown in Figure 4. As the MOCA concentration increased, the tensile strength, tear strength and modulus increased; however, the compression set increased and the pot life decreased.

Blends of MOCA and castor oil were used as curing agents for a PPG 400-2,4 TDI prepolymer (2 NCO/OH). The properties of the resulting vulcanizates are shown in Table V. Properties of an elastomer cured with castor oil alone are included for comparison. The MOCA-castor oil cured polymers were hard, had very high modulus, excellent compression set and good pot life. The tensile strength, tear strength, and Bashore Rebound were high and the moisture absorption very low.

Curing Time and Temperature. A study of curing conditions was made of MOCA cured PPG 2000-2,4 TDI prepolymers (Table II). Each of the eight prepolymers was subjected to three cures. These were:

Cure 1. 4 hours at 100°C.
Cure 2. 2 hours at 120°C.
Cure 3. 1 hour at 140°C.

The results of this investigation are listed in Table VI. Cure 1 displayed a moderate improvement over Cures 2 or 3 in modulus and tear resistance, and was only slightly better in hardness, tensile strength and Bashore Rebound. However, Cures 2 and 3 were markedly superior to Cure 1 in compression set. Cure 3 provided better abrasion resistance than either Cure 1 or 2.

TABLE VI—EFFECT OF CURING TIME AND TEMPERATURE ON PROPERTIES OF MOCA CURED PPG 2000-TDI ELASTOMERS

	4 hrs. at 100°C.	2 hrs. at 120°C.	1 hr. at 140°C.
Tensile strength (psi)	1870	1730	1690
300% modulus (psi)	805	680	645
Taber abrasion, H18 wheels, Mg. loss/1000 cycles	33.5	37	27
Graves tear (pi)	184	147	146
Shore A hardness	65	60	57
Bashore rebound	33	30	28
Compression set, 22 hrs. at 158°F., 25% deflection	28	19	18

General Discussion

Various methods of increasing the hardness of the casting elastomers and the effect on other physical properties were investigated. The following methods were found to be effective:

(1) Increasing concentration in elastomers of
  (a) Urethane and urea linkages by lowering the average molecular weight of the polyether polyols in prepolymers (Figure 1).
  (b) Urea linkages by raising the percentage of the diamine in the chain extender system (Table V) or by increasing the NCO/OH ratio of the prepolymer (Figure 2).
(2) Changing the distribution of the urethane and urea groups in the elastomers. This may be accomplished by blending PPG 2,000 with polyols having molecular weights lower than 1,000 in preparing the prepolymers (Figure 1).

Polyol-MOCA blend curing systems were a convenient means of providing hard elastomers with good processing life. However, as the percentage of the polyol in the chain extender increased, the low temperature properties became less desirable. Smith and Magnusson *(12)* have shown that the glass transition temperatures of urethane elastomers increase linearly with the concentration of urethane groups.

Diamine cured elastomers appeared to have the best combination of properties. The polar urea groups in these polymers promote strong interchain attraction through forces such as hydrogen-bonding. Further improvement in elastomer properties can be obtained by blending polyols, thereby concentrating polar groups along the polymer chain.

Polypropylene glycol based urethane casting elastomers, because of their versatility and potential low costs, should be of considerable interest for the production of mechanical and industrial rubber goods, potting compounds and coatings.

ACKNOWLEDGEMENTS

The authors wish to express their appreciation to Mr. J. M. McClellan for technical advice, to Mr. C. Hamilton for the statistical treatment of the experimental data, to Messrs. T. Graham and V. Grazulis for the physical testing, and to Mr. R. Moore for assistance in the experimental part of this investigation.

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The Vulcanized-on-Sole Process:

ADHESIVES

Third of a four-part series giving data on adhesives for rubber/leather bonds

By A. W. NICONCHUK
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THE purpose of this phase of the study of molded-on-soles was to determine suitable means of firmly attaching the sole to the leather upper. This proved to be far more involved than anticipated, due to the number of variables involved in the process.

The variables are: (1) Variety of soling stocks used and contemplated in the future. (2) Variety of leather used in shoe uppers and contemplated for future use. (3) Non-availability of a universal adhesive suitable for all types of soling materials. (4) Variety in shoe-making procedures: wide versus narrow lasting margins, heavy pleats around toe, etc. (5) Variability in preparation of shoe uppers prior to adhesive application. (6) Lack of descriptive data on an adequate bond for the molded-on process. (7) Inadequate test methods. (8) Need for fast curing adhesives.

To the best of our knowledge, there is no universal adhesive that will provide adequate bonds for all types of soling compositions. Such an adhesive is conceivable and the nearest approach to such versatility appears to be isocyanate type adhesives.

Many claims to versatility exist in adhesives, but we were unable to confirm such claims. Since the molded-on process is still in its infancy in America, it is difficult to predict whether a single adhesive will be developed that will adequately bond all types of soling stocks and upper materials.

Our adhesives study revealed that adequacy in preparation of the upper is extremely important. Proper roughing is perhaps the greatest single factor for insuring a good bond between leather and rubber. The ideal condition exists when the shoe upper is roughed to the mold bite line. This procedure removes the finish and grain surface, exposing the fibrous part of the leather.

Leather roughed at high speed becomes hard and non-receptive to adhesive penetration. Methods of roughing were not investigated by our laboratory research team. However, we did investigate bonding to a grain surface from which the finish had been completely removed. Although we were able to bond to the grain surface of the leather, the bond strength was only as strong as the strength of the thin layer that constitutes the grain membrane. This bond strength is very poor.

The width of the lasting margin and the flatness of the wrap-around at the toe constitute other important factors in good bonding. Heavy pleating in the most critical toe area minimizes contact between rubber and adhesive. Valleys of the pleats cannot be roughed free of finish. No adhesive tried will adhere firmly to the leather finish.

Our adhesives study was complicated by lack of a definition of adequate bond for the molded-on-sole. One approach to the problem of laboratory evaluation of adhesion bonds is the SATRA tester. While simpler and more convenient than other methods, the basic problem of relating laboratory test data to actual wear tests was still evident. However, since wear tests are extremely time consuming, any method which provides relative comparisons is a valuable laboratory tool for the current investigation under discussion.

The SATRA tester shown in Figure 1 operates on a simple leverage principle. The shoe, with last inserted for rigidity, is positioned so that extension of the sole at the toe area fits snugly under the spring-loaded contoured clamp. A stationary piece forward of the clamp acts as the fulcrum. Pressure exerted downward on the heel end of the shoe exerts an increasingly greater upward pressure on the spring-loaded holding clamp. This pressure, read directly in pounds force on the dial indicator, represents the force necessary to break the sole away from the upper. The SATRA is provided with a smaller holding clamp for the heel. The shoe is simply reversed and a similar reading of bond strength is determined for the heel portion of the molded-on bottom.

FIG. 1—SATRA tester operates on principle of simple leverage.

Laboratory strip test and Scott tensile test methods proved extremely valuable in screening adhesives, types of leather, and soling stocks.

Figure 2 shows the "Torture Flex Tester" designed and developed by United Shoe Machinery Corporation personnel. The forepart of the shoe flexes by means of a vertical push-rod arrangement. The platform contacting the sole is usually knurled to hold the sole stationary. Simultaneous with forepart flexing is a twisting action accomplished by a cam mechanism through the locked-down heel. Considerable force is exerted at the ball line of the shoe causing rapid failure to inferior rubber/leather bonds. This machine is used effectively for quick screening of adhesives.

Determining Suitable Bond

We did not have a positive test method for determining the bond strength between the vulcanized-on-sole and the shoe upper. Therefore, we accepted as a suitable bond: (1) the cohesive failure of the rubber, (2) leather upper failure, or (3) both. Our firmly attached soles have read 150 pounds on SATRA (maximum of tester) with no break at the toe tip.

Throughout the adhesives study, we found that thermoplastic type adhesives such as non-curing rubber cements, vinyl cements, and resinous cements were inadequate for the molded-on process. These adhesives showed poor hot bond strength and their use resulted in dislodging the sole when removing the finished shoe from the foot form. The only exception to this was B. B. Chemical Company's 675 Neoprene cement when used with a particular type American Biltrite Neoprene soling stock.

Thermosetting type adhesives proved far superior. Our heat conductivity study revealed that the thermosetting adhesives must be very fast curing. Fast curing adhesives have limited shelf life and must therefore be prepared as two part systems. One part contains the sulfur portion while the second part contains the accelerator portion.

Our investigation of adhesives and bonding was conducted primarily with ACL KEENA leather, HH weight, and oil content of seven to eight per cent by weight.

The majority of wear test shoes were made with this type leather. Other leathers used in wear test shoes included: (1) ACL FINA, (2) ACL MELGO, (3) ACL GLASCO, (4) SYLFLEX, Dow Corning Process, and (5) TROSTEL, vulcanizable leather.

The general characteristics of adhesives found suitable for process use are:

Type: Thermosetting, vulcanizable type.
Viscosity: 2 to 10,000 cps.
Cure Time: 10 minutes or less at 230°F.
Stability: 8 hour pot life when mixed, no gelling of base component.
Solvent: Fast drying solvent system (1 hour or less at room temperature.)
Other: Base material, solvent should be non-toxic for normal use.

Commercial Adhesives

Commercial adhesives which have been evaluated and found satisfactory for process use with laboratory soling stocks are:

Soling Stock	*Adhesive*
1296-38-1 Natural	BB 4903-8 A&B
1327-17 GR-S	BB 4903-8 A&B
1322-15-5 Nitrile	BB S47-36
1322-25-1 Vinyl-Nitrile	BB S47-36
American Biltrite Neoprene	BB 675

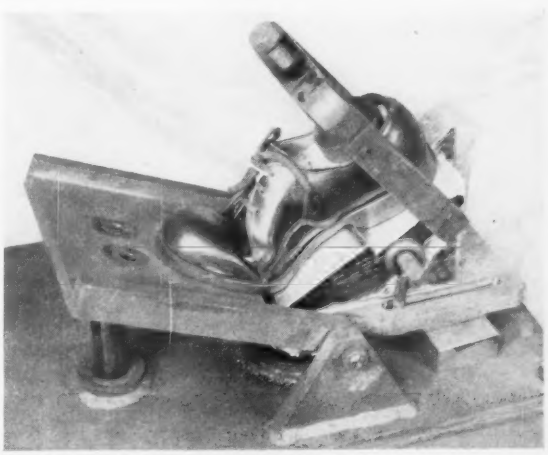

FIG. 2—"Torture Flex Tester" is used effectively for quick screening of adhesives.

Some 75 pairs of work shoes and an equal number of children's shoes were issued for wear test data. The work shoes were distributed among personnel in various industries for optimum evaluation. The children's shoes were confined to orphanages.

Of the work shoes on test, only one pair showed premature failure and this was due to adhesive failure at the rubber/leather interface. All others showed leather upper failure. There was some evidence of upper failure due to welt plate damage, but in most instances such damage was accompanied by general cracking of leather upper in the vamp area. The severity and time element of failure of uppers depended upon wear test environment such as pickling plants (fast), construction (intermediate), and indoor (slow).

Children's shoes rarely exceeded six months wear due to breakdown of uppers. Figure 3 illustrates the durability of the rubber bottom compared to upper.

FIG. 3—Rubber bottoms are remarkably durable compared to worn leather uppers. Top left: new; lower left: after 13 months. Top right: new; lower right: after 6 months.

Conclusions of Studies

Nine conclusions can be drawn:

(1) To the best of our knowledge, there is no universal adhesive available commercially that will adequately bond all types of soling stocks to the variety of leather used in shoe uppers.

(2) The best adhesives for the molded-on process are thermosetting types.

(3) Thermosetting adhesives must be sufficiently fast curing to set during the curing cycle.

(4) Maximum bond strength results from shoe uppers with wide flat lasted margins that are roughed to expose the soft, fibrous layer of the leather.

(5) Molded soles which are slightly undercured nearest the adhesive layer show good initial bond strength. Effectiveness of such a bond under actual wear test has not been determined.

(6) The degree of adequacy of bond strength between rubber and leather has not been determined. Our wear test data indicates adhesives used were highly satisfactory.

(7) A variety of leathers have been successfully bonded to various soling stocks, and have performed well under actual wear test.

(8) Two coats of adhesive, with adequate drying intervals, result in the best bonds.

(9) Viscosity of adhesive should not exceed 4,000 cps for good leather penetration. A thinned down first coat is preferable for best bonding.

Coming Soon . . .

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The purpose of this paper is to study individually and simultaneously the effect of intensity and temperature on the efficiency of vulcanization by accelerated electrons and to compare these treatments with the effects of equivalent cobalt sixty irradiation.

Vulcanized-on-Sole Process: Part IV—By A. W. Niconchuk, United Shoe Machinery Corp., Beverly, Mass.

Special studies and conclusions of an informative four-part series.

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Elastomers for Use in Radiation Fields: Part VII

- **Effect of Fillers in a Styrene-Butadiene Elastomer**
- **Effect of Gamma Radiation on Supplemental Elastomers**
- **Post Irradiation Effects on Three Elastomers**

By ROBERT HARRINGTON
Hanford Laboratories Operation,
General Electric Co., Richland, Wash.

THE previous articles in this series have presented background information on the subject of radiation damage to organic polymers and have shown how gamma radiation affects the physical properties of many classes of elastomers and some rubber-like plastics materials of construction *(1-6)*. This article continues the presentation of data on the effect specific variables have on the radiation resistance of elastomeric polymers.

Specifically, data and discussion are presented on the effect various filler loading materials have on the radiation induced changes in the physical properties of a styrene-butadiene elastomer. In addition, data are given on the post irradiation effects on three elastomers as reflected by physical property changes at various times after removal from the radiation source. Also included are data on the gamma radiation resistance of several elastomers belonging to classes previously discussed but obtained too late for inclusion in the previous articles. This supplemental information is presented in order to help keep the reader abreast of radiation damage data.

Since many variables are involved, no attempt is made here to be all inclusive. Rather, data are presented in the hope that they will be useful as engineering information and help contribute to a better understanding of how elastomers are affected by exposure to ionizing radiation.

Experimental Procedure

All materials were exposed to gamma radiation and evaluated by recording changes in physical properties, as described previously *(1)*. For all irradiations up to and including 1×10^8 r, a 1.3×10^6 r/hr cobalt-60 source at Hanford was used. In order to reduce the exposure time for the higher doses, spent fuel elements at the Materials Testing Reactor (MTR) were used. Dose rates obtainable at the MTR are in the order of 1 to 10×10^6 r/hr. Property changes resulting from the irradiation of the same materials to a given total dose in the two sources agree closely enough, so it can be assumed that the results are independent of the two sources.

Effect of Fillers in a Styrene-Butadiene Elastomer

The styrene-butadiene elastomer GR-S 1500 was selected as a typical material to study the effects fillers have on radiation induced changes. A description of the materials and fillers is given in Table I. The recipes and cure schedule for the various formulations are given in Table II. Radiation effects data on a few other styrene-butadiene elastomers have been given previously *(3)*.

Table III presents results of exposing the styrene-butadiene materials (listed in Table I) to various doses of gamma radiation in air at 25°C. and normal atmospheric pressure. This table shows original properties opposite zero irradiation dose, followed by per cent property changes resulting from various gamma radiation exposures. The original color of each material is also shown opposite zero irradiation dose. Significant color changes, and other observations needing comment, are noted in the Remarks column opposite the particular radiation dose causing the phenomena.

The data presented in Table III and in a previous article *(3)* show that all of the styrene-butadiene elastomers become increasingly hard, stiff, and brittle on prolonged exposure to ionizing radiation. In all instances the hardness of the materials increased with increasing radiation exposure while the elongation

was reduced. The tensile strength, on the other hand, did not follow any definite pattern. In some cases little or no change is noted, while in others the tensile strength can be either increased or decreased or go through cycles of increasing and decreasing as the radiation exposure is increased. In all instances the styrene-butadiene materials lose flexibility with increasing radiation dose.

Reinforcing Fillers

As noted above and in previous articles, tensile strength is generally the property affected most with respect to compounding ingredients and subsequent radiation induced change. That is, the unpredictable behavior of this property appears to be a function of both the compounding ingredients (including base polymer) and the amount of radiation exposure. Therefore, these studies on reinforcing fillers are primarily concerned with the effect these fillers have on the tensile strength of the styrene-butadiene polymer. Discussion is necessarily limited; an extremely detailed and exhaustive report is required to include the many types and classes of fillers, as well as the individual properties of each, such as: surface area, structure, reinforcing ability, effect on cure, composition and impurities, ease of incorporation, etc. Consequently, only the effect of the specific fillers studied and any noticeable general trends is treated.

The first four materials listed in Table I represent compounds containing four different loadings of a general purpose furnace (GPF) carbon black. These materials were prepared to observe the effect different levels of GPF black had on radiation induced changes to the styrene-butadiene polymer as well as serve as more or less a control series to which other types of fillers could be compared.

Figure 1 graphically illustrates how gamma radiation affects the properties of these four materials containing 20, 40, 60, and 80 parts respectively of GPF black. The illustration shows per cent change in properties rather than actual property values after the various radiation exposures. As is the case with most other elastomers, the hardness of the materials increases with increasing radiation dose; softer materials increase at a greater rate. On a per cent change basis, the elongation of the four compounds decreases almost identically. With respect to flexibility, the 20 and 40 part materials break after being exposed to 5 x 10^8 r, while the 60 and 80 part materials fail the bend test after the lower dose of 3 x 10^8 r.

The tensile strength of the four materials follows a somewhat consistent pattern. As the radiation exposure is increased to about 1 x 10^8 r the tensile strength is lowered for the 20 part material and raised for the 80 part material with the other two compounds intermediate. Beyond 1 x 10^8 r the materials

TABLE I—STYRENE-BUTADIENE ELASTOMERS USED FOR GAMMA RADIATION STUDIES ON THE EFFECT OF FILLERS

Hanford Materials	Description	Approx. Particle Size (Microns)
HW-B24	GR-S 1500-compounded with 20 parts general purpose furnace black	0.051
HW-B25	Same as above except 40 parts black	0.051
HW-B26	Same as above except 60 parts black	0.051
HW-B27	Same as above except 80 parts black	0.051
HW-B28	Same as above except 60 parts molybdenum disulfide	22.000
HW-B29	Same as above except 60 parts titanium dioxide	0.300
HW-B30	Same as above except 60 parts rubber grade graphite	10.000
HW-B31	Same as above except 60 parts conductive furnace black	0.050
HW-B32	Same as above except 60 parts super abrasion furnace black	0.025
HW-B33	Same as above except 60 parts medium thermal black	0.350

TABLE II—RECIPES OF STYRENE-BUTADIENE ELASTOMERS USED FOR GAMMA RADIATION STUDIES ON THE EFFECTS OF FILLERS

Recipe Materials	HW-B24	HW-B25	HW-B26	HW-B27	HW-B28	HW-B29	HW-B30	HW-B31	HW-B32	HW-B33
GR-S 1500	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Tuads 52-3	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Santocure	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Sulfur	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Zinc Oxide	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Agerite Resin D	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
GPF Black	20.0	40.0	60.0	80.0	—	—	—	—	—	—
SAF Black	—	—	—	—	—	—	—	—	60.0	—
MT Black	—	—	—	—	—	—	—	—	—	60.0
Titanium Dioxide	—	—	—	—	—	60.0	—	—	—	—
Molybdenum Disulfide	—	—	—	—	60.0	—	—	—	—	—
Graphite	—	—	—	—	—	—	60.0	—	—	—
CF Black	—	—	—	—	—	—	—	60.0	—	—

All compounds cured 12 minutes at 300°F.

TABLE III—EFFECTS OF GAMMA RADIATION ON THE PROPERTIES OF STYRENE-BUTADIENE ELASTOMERS

Materials	Dose ($r \times 10^{-6}$)	Initial Properties and Per Cent Change — Hardness Shore A; Δ%	Elongation %; Δ%	Tensile psi; Δ%	Remarks
HW-B24	0	63	350	1025	Black
	5	0.0	— 3.2	— 3.8	
	10	0.0	— 10.9	— 6.6	
	50	6.4	— 31.4	— 21.5	
	100	14.3	— 54.0	— 22.9	
	300	33.3	— 85.6	— 26.7	
	500	49.2	— 91.4	5.1	a
	1000	89D*	—100.0	>637.1	a, b
HW-B25	0	71	365	2070	Black
	5	0.0	0.0	— 4.0	
	10	1.4	— 14.8	— 8.0	
	50	7.0	— 39.6	— 5.4	
	100	15.5	— 61.6	— 12.5	
	300	26.8	— 83.5	— 8.4	
	500	28.2	— 89.0	— 12.3	a
	1000	88D*	—100.0	>258.8	a, b
HW-B26	0	80	250	2670	Black
	5	0.0	— 3.8	2.4	
	10	2.5	— 10.7	7.8	
	50	7.8	— 32.5	7.8	
	100	10.0	— 56.4	9.4	
	300	17.5	— 80.2	0.6	a
	500	23.1	— 92.3	— 18.7	a
	1000	91D*	—100.0	>165.0	a, b
HW-B27	0	87	180	2905	Black
	5	0.0	0.0	0.0	
	10	1.2	— 5.3	1.7	
	50	5.8	— 34.2	8.0	
	100	6.9	— 57.9	14.4	
	300	10.3	— 79.0	37.9	a
	500	12.6	— 94.4	17.4	a
	1000	91D*	—100.0	59.0	a
HW-B28	0	66	185	510	Dark Grey
	5	0.0	— 10.3	3.5	
	10	1.5	— 35.0	3.7	
	50	10.6	— 42.9	2.0	
	100	15.2	— 57.6	10.2	
	300	39.4	— 87.8	99.0	a
	500	47.5	— 95.0	99.0	a
	1000	88D*	—100.0	880.4	a
HW-B29	0	64	350	575	White
	5	0.0	— 13.8	2.4	
	10	1.6	— 19.5	8.5	
	50	6.3	— 45.4	9.6	c
	100	15.6	— 59.2	15.4	d
	300	34.4	— 85.6	41.6	e
	500	53.1	— 95.0	125.0	a, e
	1000	86D*	—100.0	1040.0	a, e
HW-B30	0	77	325	1195	Dark Grey
	5	0.0	0.0	0.8	
	10	0.0	— 11.1	8.5	
	50	6.5	— 25.9	11.5	
	100	9.1	— 63.0	16.1	
	300	18.2	— 87.7	24.1	
	500	19.3	— 90.7	47.3	a
	1000	81D*	—100.0	613.3	a
HW-B31	0	80	290	2790	Black
	5	0.0	— 11.5	0.4	
	10	1.3	— 17.2	— 1.5	
	50	6.3	— 34.7	— 2.9	
	100	10.0	— 63.2	— 12.2	
	300	17.5	— 86.1	— 10.0	
	500	21.3	— 92.1	— 17.3	a
	1000	25.0	— 96.5	— 64.7	a
HW-B32	0	82	325	3020	Black
	5	0.0	0.0	1.6	
	10	1.2	— 13.6	5.8	
	50	6.1	— 47.5	— 18.0	
	100	8.5	— 64.5	— 22.3	
	300	14.6	— 89.5	— 30.0	
	500	18.3	— 92.9	— 27.4	a
	1000	90D*	—100.0	>120.9	a, b
HW-B33	0	67	185	905	Black
	5	1.6	— 4.5	7.6	
	10	3.0	— 4.5	1.3	
	50	10.5	— 6.5	1.0	
	100	14.9	— 32.1	— 2.9	
	300	23.9	— 78.3	— 1.0	
	500	35.8	— 86.4	33.0	a
	1000	87D*	—100.0	543.1	a

* Shore D hardness scale used. a = broke when bent 180 degrees; b = exceeded tensile tester capacity; c = slightly cream colored; d = yellow-cream colored; e = darker yellow-cream. Stress cracks were first noted on all materials after an exposure of 1×10^7 r.

are increased greatly in tensile strength except that the 60 and 80 part materials drop at an exposure of 3×10^8 r before increasing. This anomally cannot be explained at present. At the highest exposure of 1×10^9 r, the materials with the least amount of GPF black increase to a greater extent in tensile strength, both on the basis of per cent change and of the actual value.

Compound HW-B26 containing 60 parts GPF black can be compared with the other carbon black and filler materials on the basis of weight loading. No attempt is made to compare effects of fillers on a volume or hardness loading basis. The data presented in Table III show again how the tensile strength behavior is dependent on the type of compounding ingredient as reflected by radiation induced changes. For all materials except HW-B31 (60 parts conductive furnace black) the tensile strength varies at the low and intermediate doses; in some instances it is lowered and in others increased. At the highest exposure the tensile strength of these materials is increased considerably.

The tensile strength of compound HW-B31 with conductive furnace black was continuously decreased as the radiation exposure was increased and was considerably lowered at the highest exposure of 1 x 10^9 r. All materials were increased in hardness and lowered in elongation as the exposures were increased. After an exposure of 5 x 10^8 r the materials, based upon retention of properties and flexibility, are rated in the following order of radiation resistance, decreasing from (1) to (5):

(1) HW-B31
(2) HW-B28, HW-B29, HW-B30
(3) HW-B24, HW-B33
(4) HW-B25, HW-B26
(5) HW-B27, HW-B32

At 1 x 10^9 r all materials are extremely stiff and brittle.

Further Studies Needed

From the foregoing discussion and data presented in Table III, it can be seen that the type and amount of filler incorporated into a styrene-butadiene elastomer can greatly regulate the changes induced by exposure to gamma radiation especially at low and intermediate doses. To understand more fully the role that fillers play with respect to radiation damage, this work indicates that further studies should include more types of fillers, more loadings of each filler, and the various individual properties of each filler. For example, the studies reported here show that particle size *per se* has had no effect on radiation induced changes.

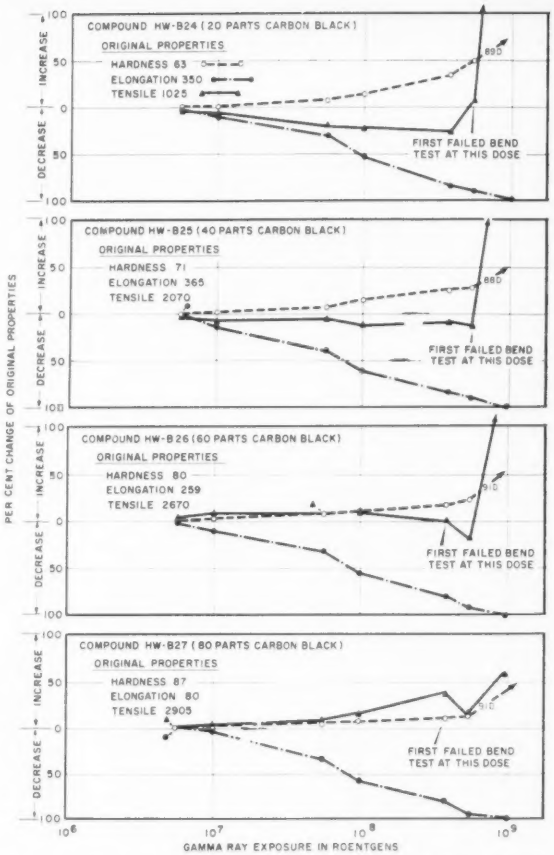

FIG. 1—Effect of carbon black on gamma radiation induced changes in properties of a styrene-butadiene elastomer.

Effect of Gamma Radiation on Various Supplemental Elastomers

The materials reported in this section are listed in Table IV. Recipes and cure schedules for the materials which are not proprietary items are given in Table V. Table VI presents the data obtained from exposing these materials, as described in the first section of this article, to several various doses of gamma radiation.

Table VI shows how gamma radiation affects the physical properties of several elastomers previously discussed, as well as elastomers in one new class, butadiene.

Butadiene. A *Cis-4* polybutadiene elastomer increased in hardness and lowered in elongation with increasing radiation exposure. Effect on tensile strength was similar to other diene elastomers, decreasing to a minimum before increasing at high exposure. Material was stress cracked by radiation induced ozone at a specified gamma radiation dose of 2.2 x 10^7 r.

A carboxy modified polybutadiene elastomer, Hycar 1000x103, was also studied in this class. This material behaved very similar to Hycar 1072 carboxy modified nitrile, reported previously *(3)*. Tensile strength and hardness increased with increasing radiation exposure, while elongation decreased. There was no evidence of stress cracking out to an exposure of 5 x 10^8 r.

Addition of Carboxy Groups

The addition of the carboxy groups to a diene type polymer appears to affect the tensile strength behavior primarily. In this instance tensile strength continuously increased with increasing radiation dose. The same was also true of the carboxy modified nitrile material. Also, the carboxy groups tend to make the compound more susceptible to embrittlement and loss of elongation as a result of exposure to radiation dosage.

TABLE IV—SUPPLEMENTAL ELASTOMERS USED FOR GAMMA RADIATION STUDIES

Material Supplier and Designation	Type or Description and Post Cure
BUTADIENE	
Phillips Petroleum Company	
Cis-4*	Polybutadiene of 95% cis configuration.
B. F. Goodrich Chemical Company	
Hycar 1000x103	Carboxy modified polybutadiene in Goodrich Chemical's Standard Recipe #2.
CHLOROSULFONATED POLYETHYLENE	
DuPont Elastomer Chemicals Department	
Hypalon A2109D-14*	Hypalon 20 polymer used.
Hypalon A2109D-15*	Same as above except Hypalon 40.
Hypalon A2109D-16*	Hypalon 20 polymer used.
Hypalon A2109D-17*	Same as above except Hypalon 40.
FLUOROCARBON	
Precision Rubber Products Corporation	
PR 18007	Proprietary material based on Viton A, a copolymer of vinylidene fluoride and hexafluoropropylene.
PR 1900-X170	Proprietary material based on Viton B.
Dupont Elastomer Chemicals Department	
Viton 214	Compound based on Viton B.
SILICONE	
General Electric Company	
SE-362	Methyl vinyl (24/480).
SE-372	Methyl vinyl (24/480).
SE-382	Methyl vinyl (24/480).
XE-4401	Methyl vinyl (24/450).
XE-4501	Methyl vinyl (24/480).
SE-525	Methyl phenyl vinyl (1/300).
NRS-X5602	Nitrile silicone (1/400).
Dow Corning Corporation	
Silastic 52	Methyl vinyl (24/480).
Silastic 82	Methyl vinyl (24/480).
Silastic 1601	Methyl vinyl (1/300).
Silastic 1602	Methyl vinyl (1/300).
Silastic LS-63	Fluorocarbon silicone (8/400).
Silastic 6543	Methyl phenyl vinyl (4/480).
URETHANE	
DuPont Elastomer Chemicals Department	
Adiprene L 312*	Adiprene L cast slabs. Cured with MOCA amine curing agent for 3 hours at 100° C.
Adiprene L	Adiprene L cast film cured at room temperature by reaction with moisture in air.
Precision Rubber Products Corporation	
PR 635-X1	A proprietary material.
General Tire and Rubber Company	
SR-59192	Experimental millable urethane elastomer.

*See Table V for recipes and cure schedules.

Chlorosulfonated Polyethylenes. Identical heat resistant compounds (A2109D-16 and A2109D-17) and water resistant compounds (A2109D-14 and A2109D-15) were formulated to compare the radiation resistance of Hypalon 20 polymer with the newer Hypalon 40. It should be noted that compounds A2109D-14 and A2109D-16 are identical respectively with A2109D-3 and HW-B8 reported previously *(3)*. The data in Table VI show that the two polymers are essentially affected in the same manner by ionizing radiation. A comparison of compounds A2109D-14 and A2109D-16 with their counterparts reported in reference *(3)* shows that the materials are also affected in the same manner.

Fluorocarbons. Three materials based on Viton polymer were examined. Two of these materials were

TABLE V—RECIPES OF SUPPLEMENTAL ELASTOMERS USED FOR GAMMA RADIATION STUDIES

BUTADIENE

All materials cured 30 minutes at 307°F.

Recipe Materials	Parts by Weight
Cis-4 Polybutadiene	100.
HAF Black	50.
Zinc Oxide	3.
Stearic Acid	2.
Flexamine	1.
Resin 731D	5.
Philrich 5 Oil	5.
Sulfur	1.75
NOBS Special	1.

CHLOROSULPHONATED POLYETHYLENES

All materials cured 30 minutes at 307°F. A2109D-14 is same as A2411A-277 of Reference *(3)*. A2109D-16 same as HW-B8 Reference *(3)*

Recipe Materials	A2109D-14	A2109D-15	A2109D-16	A2109D-17
Hypalon 20	100.	—	100.	—
Hypalon 40	—	100.	—	100.
Stabelite Resin	2.5	2.5	5.	5.
Agerite Resin D	—	—	2.	2.
Antox	2.	2.	—	—
NBC	1.	1.	1.	1.
SRF Black	30.	30.	—	—
Super Multifex	—	—	45.	45.
Kenflex A	—	—	10.	10.
Litharge, sublimed	40.	40.	20.	20.
Maglite D	—	—	10.	10.
Tetrone A	.75	.75	.75	.75
MBTS	.5	.5	.5	.5

FLUOROCARBON

All materials cured 30 minutes at 300°F. and post cured 24 hours at 400°F.

Recipe Materials	Parts by Weight
Viton LCD-234	100.
MT Black	20.
Magnesia	15.
Diak No. 2	1.

compounded from the new Viton B (PR 1900-X170 and Viton 214) while the third, PR 18007, was made from the older Viton A. The two Viton B materials became quite tacky and brittle after an exposure of 1×10^8 r and were extremely brittle and tacky after a dose of 3×10^8 r as compared with the Viton A compound here and those studied in previous articles. From the data presented here it appears that compounds from Viton B would be slightly inferior to compounds from Viton A with respect to radiation resistance.

Silicones—Methyl Vinyl. The nine methyl vinyl silicone elastomers included here behaved in much the same manner as those previously reported *(2, 4, 6)*. Hardness increased and elongation decreased with increasing radiation dose. Tensile strength follows no definite pattern; it is increased, decreased (or combination) with increasing exposure.

Silicones—Methyl Phenyl Vinyl. The two methyl phenyl vinyl silicones examined exhibited the same pattern of property changes as did those reported in the other articles *(2, 4, 6)*. The tensile strength and elongation were decreased with increasing dose while the hardness was increased.

Silicone—Fluorocarbon. Silastic fluorocarbon LS-63 was affected in the same manner as the methyl phenyl vinyl materials and the Silastic LS-53 previously reported *(2)*.

Silicone—Nitrile. Due to lack of test specimens only two exposures were made with the nitrile silicone NRS-X5602. From the limited amount of data obtained it appears that the properties of this material behave in the same fashion as the methyl phenyl vinyl silicones.

Silicones—General. From the data reported here and in the references cited above, the silicones taken as a whole sustain radiation damage at a rapid rate to about 1×10^8 r at which time most of them will break when bent 180 degrees. However, after this exposure, the rate of damage appears to be reduced and most of the materials appear capable of being used for static applications or where minimum dynamic usage is required to doses of 3×10^8 r or perhaps 5×10^8 r.

In general the methyl phenyl vinyl, fluorocarbon, and nitrile silicones are affected by ionizing radiation in the same manner as discussed above. At about 3×10^8 r there is an indication that the tensile strength of these materials would assume an increasing trend at higher doses. The other silicone types are all affected in the same manner with respect to hardness and elongation. The tensile strength of these materials, however, does not follow any consistent pattern. In general, the methyl phenyl vinyl materials exhibit the best radiation resistance with respect to retention of properties and flexibility, while the fluorocarbon types are the poorest.

Urethanes. Four urethane compounds were studied. Two were cast from the liquid polymer Adiprene L, and two were compounded from urethane rubber gum. The cast materials were superior in their radiation resistance and possessed a fair amount of strength and flexibility after the high dose of 1×10^9 r. The other two materials decreased somewhat in hardness and became tacky at the intermediate doses, indicating chain cleavage of the base polymer during irradiation. The experimental millable urethane elastomer became tack free and harder as the exposures went out to 1×10^9 r indicating that cross-linking was predominating. The tensile strength of all of the materials was reduced with increasing exposure out to the high doses where it assumed an increasing trend. The property changes recorded here are in accordance with those noted for other urethane elastomers in the previous articles *(2, 4)*. The data presented on the Adiprene L compounds confirm again that the urethane polymers are among the most radiation resistant elastomers.

TABLE VI—EFFECT OF GAMMA RADIATION ON SUPPLEMENTAL ELASTOMERS

Materials	Dose (r x 10^{-6})	Initial Properties and Per Cent Change: Hardness Shore A; Δ%	Elongation %; Δ%	Tensile psi; Δ%	Remarks
BUTADIENE					
Cis-4	0	63	540	2600	Black
	22	11.1	— 44.4	— 22.7	a
	55	17.5	— 63.0	— 30.8	
	100	22.2	— 72.2	— 36.7	
	500	49.2	— 97.2	— 50.2	b
	1000	58.7	—100.0	— 35.8	b, c
Hycar 1000x103	0	79	335	2240	Black
	5	1.3	— 1.5	18.1	
	22	5.1	— 35.8	30.6	
	100	17.7	— 85.1	19.0	
	300	83D*	—100.0	138.8	b
	500	91D*	—100.0	184.1	b, c
CHLOROSULFONATED POLYETHYLENE					
Hypalon A2109D-14	0	72	275	2315	Black
	5	0.0	— 10.9	9.8	
	22	2.8	— 32.7	0.6	
	55	13.9	— 70.4	— 16.0	
	100	20.8	— 85.5	— 34.3	
	300	33.3	— 96.4	— 0.4	
	500	38.9	—100.0	19.4	b, c
Hypalon A2109D-15	0	75	285	2785	Black
	5	0.0	— 12.3	— 4.3	
	22	1.3	— 38.6	— 6.1	
	55	9.3	— 71.9	— 25.1	
	100	17.3	— 86.0	— 39.5	
	300	29.3	— 96.5	1.1	b
	500	33.3	—100.0	28.9	b, c
Hypalon A2109D-16	0	74	305	2300	Olive
	5	1.4	11.5	— 0.2	
	22	2.7	— 11.5	1.3	
	55	10.8	— 50.8	— 5.4	
	100	13.5	— 70.5	— 6.1	
	300	28.4	— 90.2	46.3	b
	500	35.1	— 98.4	54.8	b, d
Hypalon A2109D-17	0	73	415	2985	Olive
	5	0.0	10.8	12.7	
	22	2.7	— 13.9	1.9	
	55	11.0	— 42.2	7.0	
	100	15.1	— 71.1	— 7.2	
	300	30.1	— 92.8	35.3	b
	500	37.0	— 97.5	38.0	b
FLUOROCARBON					
PR 18007	0	69	300	1395	Black
	5	4.3	— 36.7	3.7	
	22	8.7	— 66.7	15.9	
	55	17.4	— 80.0	— 12.1	e
	100	26.1	— 86.7	— 19.0	b, f
PR 1900-X170	0	75	225	1800	Black
	5	2.7	— 20.0	16.7	
	22	9.3	— 55.6	10.6	
	55	16.0	— 73.3	4.4	e
	100	27.7	— 82.2	16.9	b, g
	300	32.0	— 93.3	114.7	b, c, h
FLUOROCARBON (*Cont.*)					
Viton 214	0	73	400	2115	Black
	5	2.7	— 35.0	— 9.2	
	22	8.2	— 72.5	— 18.4	
	55	16.4	— 82.5	— 7.8	
	100	20.5	— 90.0	— 6.1	b, g
	300	82D*	—100.0	76.4	b, c, h
SILICONE					
SE-362	0	62	130	675	Red
	5	6.5	— 30.8	20.7	
	22	19.4	— 46.2	— 3.7	
	55	30.6	— 69.2	10.4	b
	100	41.9	— 80.8	10.4	b
	300	51.6	—100.0	27.4	b, c
SE-372	0	65	110	690	Red
	5	4.6	— 18.2	5.1	
	22	20.0	— 36.4	34.1	
	55	30.8	— 68.2	38.0	b
	100	38.5	— 81.8	40.6	b
	300	49.2	—100.0	53.6	b, c
SE-382	0	79	75	805	Red
	5	1.3	— 20.0	24.8	
	22	7.6	— 33.3	33.5	b
	55	15.2	— 60.0	55.9	b
	100	19.0	— 86.7	59.0	b
	300	24.1	—100.0	174.5	b, c
XE-4401	0	52	340	740	Grey
	5	1.9	— 8.8	10.8	
	22	17.3	— 52.9	— 4.7	i
	55	36.5	— 79.4	— 20.9	j
	100	53.8	— 88.2	— 25.7	j, b
	300	75.0	— 98.5	— 25.7	b, k
XE-4501	0	66	260	975	White
	5	3.0	— 7.7	10.3	
	22	13.6	— 50.0	— 4.1	
	55	22.7	— 76.9	— 9.2	
	100	33.3	— 84.6	— 20.5	b
	300	43.9	—100.0	— 23.1	b, c
SE-525	0	31	750	815	Grey
	5	6.5	— 6.7	0.6	
	22	29.0	— 46.7	— 20.4	l
	55	74.2	— 78.7	— 31.3	j
	100	109.7	— 90.7	— 46.6	j
	300	174.2	— 98.7	— 57.1	b, j
NRS-5602	0	63	320	1025	Cream, m
	100	33.3	— 87.5	— 46.8	n, o
	300	54.2	— 98.4	— 36.1	b, o
Silastic 52	0	50	365	840	Tan cream
	5	6.0	— 23.3	— 11.3	
	22	28.0	— 57.5	— 16.1	p
	55	46.0	— 80.8	— 20.2	p
	100	60.0	— 89.0	— 29.2	b, p
	300	84.0	— 98.6	— 26.2	b, c, p
Silastic 82	0	75	245	930	Tan cream
	5	2.7	— 18.4	— 5.9	
	22	9.3	— 46.9	8.1	
	55	16.0	— 79.6	6.5	
	100	20.0	— 87.8	10.8	b
	300	28.0	—100.0	**	b, q

TABLE VI—EFFECT OF GAMMA RADIATION ON SUPPLEMENTAL ELASTOMERS

Materials	Dose (r x 10^{-6})	Initial Properties and Per Cent Change: Hardness Shore A; Δ%	Elongation %; Δ%	Tensile psi; Δ%	Remarks
SILICONE (*Cont.*)					
Silastic 1601	0	57	575	960	Tan
	5	5.3	— 13.0	8.9	
	22	22.8	— 58.3	— 21.1	
	55	29.8	— 86.1	— 4.4	
	100	47.4	— 92.2	— 4.2	b
	300	66.7	—100.0	— 13.9	b, c
Silastic 1602	0	58	520	1145	Tan cream
	5	8.6	— 17.3	— 3.5	
	22	24.1	— 59.6	— 7.9	
	55	39.7	— 80.8	— 13.1	
	100	46.6	— 90.4	— 20.5	b
	300	58.6	— 99.0	— 29.3	b
Silastic LS-63	0	68	185	1035	White
	5	1.5	— 24.3	— 25.6	r
	22	7.4	— 62.6	— 55.1	s
	55	13.2	— 78.4	— 59.9	b, t
	100	19.1	— 89.2	— 62.3	b, u
	300	35.3	— 97.3	— 54.1	b, u
Silastic 6543	0	73	415	1345	Red
	5	0.0	— 3.8	— 6.0	
	22	6.4	— 41.0	— 18.6	
	55	17.8	— 90.4	— 42.4	b
	100	20.5	— 95.2	— 56.3	b
	300	32.9	—100.0	**	b, q

Materials	Dose (r x 10^{-6})	Initial Properties and Per Cent Change: Hardness Shore A; Δ%	Elongation %; Δ%	Tensile psi; Δ%	Remarks
URETHANE					
Adiprene L 312	0	90	480	4800	Dark tan
	5	0.0	— 2.3	5.5	
	22	0.0	— 8.2	— 26.7	v
	55	0.0	— 37.2	— 54.8	w
	100	0.0	— 56.7	— 63.1	x
	300	2.2	— 81.4	— 74.2	x
	500	2.2	— 83.7	— 70.2	x
	1000	2.2	— 83.7	— 60.8	x
Adiprene L	0	***	585	3000	Light tan
	100	—	— 79.5	— 72.2	y
	500	—	— 88.0	— 81.5	y
	1000	—	— 98.3	— 69.4	y
PR 635-X1	0	69	440	4095	Black
	5	— 1.4	0.0	— 7.5	
	22	— 7.2	15.9	— 22.3	
	55	—14.5	— 23.9	— 40.2	e
	100	—17.4	— 47.7	— 60.8	f
	300	— 1.4	— 81.8	— 77.4	z
SR-59192	0	68	600	2910	Black
	5	— 2.9	— 5.0	— 7.9	
	22	—10.3	— 16.7	— 24.9	
	55	—11.8	— 48.3	— 49.3	e
	100	— 7.4	— 66.7	— 59.1	g
	300	0.0	— 88.3	— 98.3	h
	500	1.5	— 91.7	— 84.4	e
	1000	25.0	— 87.5	— 82.6	b

* Shore D hardness scale used. **Specimen broke in tensile machine jaws. ***Hardness not applicable for approx. .020 inch film. a = stress cracks first appeared at this dose; b = broke when bent 180 degrees; c = quite brittle; d = appeared to be best of Hypalons; e = slightly tacky; f = slightly more tacky; g = quite tacky h = very tacky; i = very light green; j = slightly darker green; k = pale green; l = light green; m = ASTM D412-51T Die D specimens used; n = barely broke; o = slightly darker cream; p = slightly darker tan; q = very brittle; r = very light blue grey; s = light blue grey; t = blue grey; u = darker blue grey; v = slightly darker; w = dark brown; x = black; y = dark amber; z = extremely tacky.

Post Irradiation Effects on Three Elastomers

The first article in this series *(1)* presented data on the post irradiation effects of a styrene-butadiene elastomer. The study was made to determine whether or not physical properties would be affected or changed as a function of time after removal from the radiation source. The work was carried out with the elastomer for a period of time from one hour to three days after removal from the radiation source. From the data obtained it was concluded that there was no post irradiation effect at least up to three days, and therefore considerable leeway was afforded from the termination of irradiations and the time the material was able to be physically examined by technicians.

The current work was designed to see if there were any post irradiation effects up to a period of a year. A material may be subject to irradiation and then be used elsewhere. For this work three materials were selected as described in Table VII. Table VIII presents the data obtained from testing the materials after removal from the gamma radiation source.

The data from Table VIII is graphically illustrated in Figure 2 which shows per cent change in properties as a function of different testing times after removal from the radiation source. With respect to the PR 408-70 styrene-butadiene material and the Vyram acrylic compound which both apparently are crosslinked as a result of irradiation, there are no property changes as a function of time of removal from the source. The butyl rubber material, PR 907-70, which is chain-cleaved on irradiation, exhibits no change in elongation or tensile strength as a function of removal. However, the hardness after eight months was lowered 8.2 per cent of its original value and after a year, the hardness was lowered 12.3 per cent.

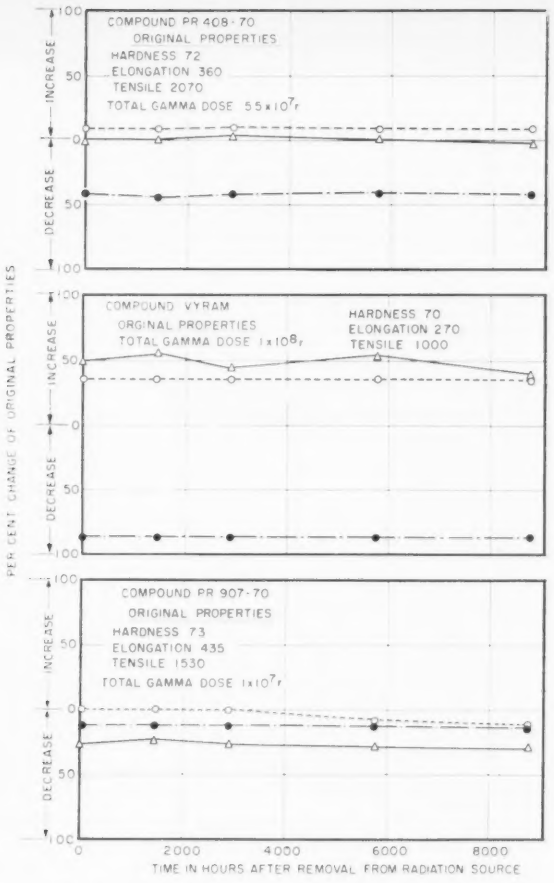

FIG. 2—Change in properties of elastomers with time.

The unirradiated control samples were lowered 2.7 and 5.5 per cent respectively for the same periods. This anomoly cannot be explained at present, and it appears that the hardness of the butyl rubber does exhibit a mild post irradiation effect. However, as tensile strength and elongation were not affected, it is concluded from the other materials studied here and those reported previously *(1)* that elastomers are unaffected by post irradiation effects up until at least a year after removal from the radiation source as reflected by physical property changes. It is also concluded the same would hold true for other total doses than reported here.

ACKNOWLEDGEMENT

Acknowledgement is made to the various suppliers of materials for their cooperation in submitting test samples and pertinent materials information. It should be noted that many of the materials evaluated might never have been developed or intended by the manufacturers for the conditions to which they have been subjected. Any failure or poor performance of a material is not necessarily indicative of the material under less stringent conditions or other applications.

TABLE VII—MATERIALS USED FOR POST IRRADIATION EFFECTS STUDIES

Material	Description
PR-408-70*	Styrene-butadiene copolymer. A proprietary material.
Vyram**	Polyacrylic rubber.
PR 907-70***	Butyl rubber. A proprietary material.

*See reference (1) for more data and post irradiation effects, and reference (3) for supplier and radiation effects data. **See reference (3) for supplier, recipe, and radiation effects data. ***See reference (4) for supplier and radiation effects data.

TABLE VIII—POST IRRADIATION EFFECTS IN THE PHYSICAL PROPERTIES OF ELASTOMERS

Dose (rx10⁻⁶)	Hours After Removal	Percent Change in Properties — Hardness	Elongation	Tensile	Remarks
		PR 408-70			
		72.0	360.0	2070.0	Original Properties
55	1	8.5	—42.6	0.8	a
55	1440	8.5	—45.4	0.5	
55	2880	9.9	—42.6	3.4	
55	5760	8.5	—41.3	0.8	
55	8760	8.5	—42.6	— 2.3	
		VYRAM			
		70.0	270.0	1000.0	Original Properties
100	1	35.3	—87.2	50.0	b, c
100	1440	35.3	—87.2	55.7	b, c
100	2880	35.3	—87.2	45.5	b, c
100	5760	35.3	—87.2	54.2	b, c
100	8760	35.3	—87.2	39.1	b, c
		PR—907-70			
		73.0	435.0	1530.0	Original Properties
10	1	0.0	—12.4	—27.9	
10	1440	0.0	—12.4	—25.1	
10	2880	0.0	—12.4	—27.9	
10	5760	— 8.2	—13.6	—29.7	d
10	8760	—12.3	—13.6	—30.5	d

a = see reference (1) for additional data on post irradiation effects; b = broke when bent 180 degrees; c = tensile strength data differs with that given in reference (3) which is attributed to different batch of material; hardness change in control as a function of time: original hardness of PR 907-70 = 73; hardness after shelf aging for 5760 hours = 71 (–2.7% change); hardness after shelf aging for 8760 hours = 69 (–5.5% change).

Acknowledgement is also made to D. L. Hunke of the Phillips Petroleum Company, Idaho Falls, Idaho, operators of the MTR for the A.E.C., and to F. M. Newby of the Hanford Atomic Products Operation. This work was performed under Contract No. AT(45-1)-1350 for the U.S.A.E.C.

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Determination of Latex Particle Size Distributions By Fractional Creaming With Sodium Alginate

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KNOWLEDGE of mass distribution of particle sizes in latex is very important to the latex technologist. Therefore, it is desirable to have available a simple method for the determination of mass distribution of particle sizes. This paper presents a method, based on fractional creaming of latex with sodium alginate, which can be used in any laboratory without special equipment. The method is particularly advantageous for analyzing latices of very wide particle size distributions. When determined with an electron microscope, these latices would require counting a very large number of particles.

McGavack *(3)* found that partial creaming of normal Hevea latex with ammonium alginate gives concentrates of larger average particle size than the original latex. He found that average particle size in cream approaches the original latex as amount of creaming agent is increased. In a previous paper from this laboratory, Schmidt and Kelsey *(4)* demonstrated that phenomenon of fractionation according to particle size with increasing amounts of creaming agent is applicable in a wide variety of anionic latex systems and in colloidal silica. Their results indicated also the existence of a quantitative relationship, independent of nature of dispersed particles, between concentration of creaming agent and size of creamed particles. Maron *(2)* confirmed fractionation with respect to particle size as a consequence of partial creaming with alginate. He showed that mass average particle sizes of fractions, determined optically, cumulate to that of the original latex.

Although the previous paper by Schmidt and Kelsey *(4)* implied the basic concept of a method of determining particle size distribution by fractional creaming, they did not exploit the concept at that time. In order to adapt the fractional creaming phenomenon to a quantitative method for particle size determination, we required a more precise knowledge of relation between creaming agent concentration and size of particles creamed. It was proposed to establish this relationship with the aid of the electron microscope. Various factors influencing the creaming of latex, such as polymer concentration, electrolyte, soap content, and variability of the creaming agent, had to be considered in standardizing the creaming procedure.

Definitions and Materials

(1) **Polymer content:** actual polymer plus adsorbed soap.

(2) **Aqueous phase:** total system minus the polymer content.

(3) **Cream:** that portion of the polymer comprising particles of diameter equal to, or greater than, the minimum size which can be creamed by the prevailing concentration of creaming agent under the conditions of the experiment.

(4) **Skim:** the entire system minus the cream.

It will be noted that these definitions of cream and skim differ from the usual concept of a cream layer and a skim layer *(5)*. The definitions of cream and skim adopted here are unambiguous and lend themselves to the simple mathematical treatment employed, for which all of the required information is obtained from polymer content of the skim.

The following materials were used: sodium alginate (Kelcosol from the Kelco Company), of viscosity approximately 15 cp. in 0.1 per cent aqueous solution at 25°C. in absence of Santobrite. The viscometer was a Kimble size 200 Fenske type. The viscosity was 31.5 cp. when measured with a Model LVF Brookfield Number 1 spindle at 60 revolutions a minute. Sodium pentachlorphenate (Sanobrite Powder from Monsanto); Dialyzer tubing (1⅛ inch diameter cellophane); Potassium oleate, 20 per cent solution.

Experimental Procedure

(1) A stock solution of fresh sodium alginate was prepared containing 1 per cent alginate and 0.1 per cent sodium pentachlorphenate. Allowance was made for the moisture content of the Kelcosol, which runs about 8 to 12 per cent of the commercial product. It is advisable to determine the total solids of the final solution. This creaming agent solution was kept under refrigeration when not in use, and made up fresh after about a month.

(2) To a quantity of latex containing 100 grams of latex solids were added 4.0 grams of potassium-oleate as a 20 per cent solution, and enough distilled water to make a total of 1000 grams of nominally 10 per cent latex. This mixture was analyzed for total solids, and the concentration of latex solids was calculated from the known soap content and the total solids.

(3) A number of mixtures was prepared containing a constant amount of latex solids and varying amounts of sodium alginate, by mixing thoroughly 50 gram portions of the above soap stabilized 10 per cent latex with the desired amounts of the sodium alginate solution and enough distilled water to make 200 grams of mixture. The quantities of sodium alginate to be used depend on the particle size at which it is desired to make the separation. The required concentrations of alginate may be taken from Figure 1 or Table II. Representative examples of the data involved in a creaming series are shown in Table I. The number of mixtures required will depend on the precision with which it is desired to determine the distribution. In most cases about 10 mixtures are sufficient, but for routine control work this number can be reduced.

(4) The various, well stirred, latex mixtures were immediately poured into separatory funnels of appropriate size and allowed to cream at room temperature for 24 to 48 hours.

(5) The polymer content of the mixtures was determined from the following relationship:

$$C_{pm} = \frac{S_m - (C_s + C_{uf})}{1 - (C_s + C_{uf})} \qquad (I)$$

This method of calculating polymer content was used in preference to a direct determination of polymer content because of its convenience.

C_{pm} = polymer concentration of the mix (weight fraction of the mix).

C_s = concentration of added soap (weight fraction of the aqueous phase).

C_{uf} = concentration of the ultrafiltrate solids (weight fraction of the aqueous phase).

S_m = one fourth of the total solids concentration of the 10 per cent latex stock solution. Represents the total solids of a creaming mixture prepared without any alginate (weight fraction of mix).

The weight of aqueous phase in a given weight of creaming mix is equal to:

$$\frac{\text{weight of mix} - \text{weight of latex solids in the mix}}{1 - C_{uf}}$$

The weight of latex solids is obtained from the previously calculated latex solids content of the 10 per cent latex stock solution. The weight of aqueous phase is constant for all mixes, but the composition varies.

In practice, a negligible error is committed if the denominator above is set equal to 1.0.

The ultrafiltrate was obtained from a portion of the original latex diluted without added soap to a latex solids equal to one fourth that of the 10 per cent latex stock solution. About 500 grams of this diluted latex was placed in a well washed and dried dialysis tubing which was then hung in a closed container. The ultrafiltrate was allowed to collect in the bottom of the container simply by the hydrostatic pressure of the latex in the tubing. By the time the creaming operation was finished, sufficient ultrafiltrate had collected to allow determination of its solids content (C_{uf}). Any turbidity in the ultrafiltrate indicates leakage and the collection of ultrafiltrate must be repeated.

(6) After the mixtures had been allowed to cream for 24 to 48 hours, the skim fractions were analyzed for total solids. The first few drops of skim, withdrawn from the bottom of the separatory funnel, were discarded and the major portion of the skim was withdrawn for solids determination, leaving behind enough skim to avoid contamination of the sample with cream. The polymer concentrations of the skim portions were calculated from the relation:

$$C_{ps} = \frac{S_s - (C_s + C_{uf} + C_{sa} + C_k)}{1 - (C_s + C_{uf} + C_{sa} + C_k)} \qquad (II)$$

where

C_{ps} = polymer concentration of skim (weight fraction of skim).

S_s = solids concentration of skim (weight fraction of skim).

C_{sa} = Santobrite concentration (weight fraction of aqueous phase).

C_k = Kelcosol concentration (weight fraction of aqueous phase) and the others are as previously defined.

(7) The weight fraction of the total polymer remaining in the skim of each mixture was calculated from the relation:

$$M_s = \frac{C_{ps}}{C_{pm}} \times \frac{1 - C_{pm}}{1 - C_{ps}} \qquad (III)$$

M_s = fraction of the polymer remaining in the skim, and therefore the fraction of the polymer below a critical particle size corresponding to the creaming agent concentration.

TABLE I—FRACTIONAL CREAMING OF LATEX FR-S 2105 BATCH II WITH KELCOSOL CONSTANT POLYMER CONTENT

Number of Creaming Mix			1	2	3	4	5	6	7	8	9	10	11
Latex FR-S 2105, Batch II, 62.5% T.S.	167	grams											
K-Oleate 20%	20	grams											
Distilled H_2O	813	grams											
"10%" Latex Stock Solution	1000	grams	50	50	50	50	50	50	50	50	50	50	50
Per cent T.S. of "10%" Latex Stock Solution	10.84	%											
Per cent Latex Solids of "10%" Stock Solution	10.44	%											
Kelcosol solution 0.885% (grams)*			3.9	5.8	7.9	10.5	15.7	19.5	22.5	24.7	26.4	31.2	39.0
Distilled H_2O (grams)			146.1	144.2	142.1	139.5	134.3	130.5	127.5	125.3	123.6	118.8	110
$S_{s'}$: Solids of Skim (weight fraction x 10^3)			2.524	2.448	2.378	2.274	2.042	1.752	1.447	1.212	1.083	0.689	0.510
C_{pm}: Polymer in Mix Prior to Creaming (weight fraction x 10^3)			2.475	2.475	2.475	2.475	2.475	2.475	2.475	2.475	2.475	2.475	2.475
C_{ps}: Polymer in Skim (weight fraction x 10^3)			2.27	2.19	2.11	1.99	1.74	1.42	1.10	0.85	0.72	0.30	0.08
M_s: Mass Fraction of Polymer Remaining in Skim x 10^3			91.7	88.1	84.7	80.0	69.5	56.8	43.8	33.9	28.4	11.7	3.03
C_k: Kelcosol Concentration on Aqueous Phase (weight fraction x 10^3)			0.0178	0.0264	0.0360	0.0479	0.0716	0.0889	0.103	0.113	0.121	0.142	0.178
C_{so}: Santobrite Concentration on Aqueous Phase (weight fraction x 10^3)			0.0018	0.0027	0.0036	0.0048	0.0071	0.0089	0.010	0.011	0.012	0.014	0.018
C_{ur}: Concentration of Ultrafiltrate (weight fraction of aqueous phase) x 10^3			0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136	0.136
C_s: Concentration of Added Soap (weight fraction of aqueous phase x 10^3)			0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.103	0.103

* Containing 0.088% Santobrite

FIG. 1—Calibration of sodium alginate concentration against latex particle size.

(8) The cumulative mass distribution of particle sizes (Figure 5, 6) was obtained by plotting M_s against the particle diameters corresponding to the alginate concentrations used. These diameters are obtained from the calibration curve in Figure 1. To avoid the difficulty of accurately reading Figure 1, the alginate concentration for selected values of particle size are tabulated in Table II. In practice, the data in Table II can be used to construct a graph on an adequate scale or one can interpolate linearly between adjacent values.

TABLE II—CALIBRATION OF SODIUM ALGINATE CONCENTRATION AGAINST PARTICLE SIZE

Particle Diameter Angstrom Units	Sodium Alginate Concentration (% aq. phase)	Particle Diameter Angstrom Units	Sodium Alginate Concentration (% aq. phase)
500	0.525	2200	0.0545
550	0.415	2400	0.0490
600	0.310	2600	0.0450
650	0.285	2800	0.0410
700	0.265	3000	0.0375
750	0.235	3200	0.0350
800	0.220	3400	0.0335
850	0.195	3600	0.0320
900	0.185	3800	0.0305
950	0.170	4000	0.0290
1000	0.160	4250	0.0275
1100	0.135	4500	0.0255
1200	0.118	4750	0.0240
1300	0.105	5000	0.0225
1400	0.0945	5500	0.0215
1500	0.0860	6000	0.0195
1600	0.0780	6500	0.0180
1700	0.0730	7000	0.0170
1800	0.0680	7500	0.0160
1900	0.0640	8000	0.0150
2000	0.0610	9000	0.0130
		10,000	0.0110

A method was developed for the determination of the mass distribution of particle sizes in latex, by fractional creaming with sodium alginate. This method was based on the observation that the size of creamed latex particles depends quantitatively on the prevailing concentration of sodium alginate, regardless of the nature of the latex. A calibration curve indicating inverse proportionality between creaming agent concentration and size of particles creamed was prepared with the aid of the electron microscope. By the use of this calibration curve particle size distributions of latices over a range from 500 to 10,000 Angstrom Units diameter can be determined with only an analytical balance and a number of separatory funnels. This method is particularly advantageous for analyzing latices of very wide particle size distributions, which, when examined with an electron microscope would require the counting of a very large number of particles. Detailed procedures and applications of this method are described.

The Calibration Curve

The calibration curve in Figure 1 was constructed from mass-particle size distributions determined by electron microscope, and fractional creaming curves obtained on each of five widely different latices. The fractional creaming curves, illustrated in Figure 2, were obtained by plotting M_s as calculated above against sodium alginate concentration. The latices used were normal Hevea latex, Copo S-2110 latex, two batches of FR-S 2105, an FR-S 1500 type latex and a polychlorostyrene latex. The ability of fractional creaming to distinguish between latices is apparent in these curves. Each of the first three of these latices, shown in Figure 3, covers a wide range of particle sizes.

The electron microscope determination of mass distribution of particle sizes, in latices having a wide distribution of sizes, is subject to large sampling errors. To reduce the sampling error, each latex was divided into a series of relatively narrow fractions so that each fraction could be accurately analyzed with the electron microscope. This fractionation was performed by means of an incremental creaming operation, in which a large volume of dilute latex (2.5 per cent solids) was treated with a small amount of creaming agent. The cream layer was removed and another increment of creaming agent was added to the skim to produce a second cream fraction. This process was repeated until the final skim contained only a small portion of the total polymer. The fraction of the total polymer creamed by each increment of sodium alginate is equal to $1\text{-}M_s$. M_s is determined from equation III, with the requirement that C_{pm} for each fractionation corresponds to C_{ps} from the previous fractionation. Correction is made for small dilution with the incremental amount of creaming agent solution added.

The frequency distributions of particle sizes in each cream fraction and the final skim are determined with the electron microscope and the histogram plotter described by Kelsey and Hanson *(1)*. A correction for bromination of the latex particles is applied to all latices except polychlorostyrene by reducing the diameter 9.6 per cent. The number of particles counted varies from fraction to fraction, but the total for a given latex is in the vicinity of 3,000 particles. Because of the advantage gained by fractionation, this number is considered adequate for reasonable accuracy. The frequency distributions for the fractions are each converted to mass distributions, which are then weighted according to the proportion of total polymer present in each fraction. The weighted mass distributions are summed over the latex fractions to produce the mass distribution for the whole latex. Cumulation of this distribution over the size groups gives the cumulative mass distribution of the whole latex. Figure 3 shows the cumulative mass distributions of particle sizes in each fraction of FR-S 2105 batch 2, and the resulting cumulative distribution for the whole latex. Cumulative mass distributions of particle sizes for each of the calibration latices are shown in Figure 4.

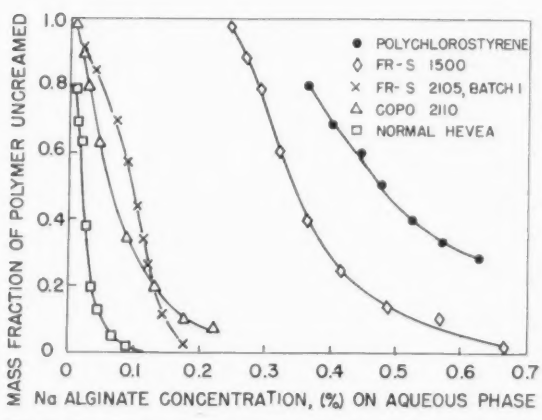

FIG. 2—Fractional creaming curves were obtained by plotting M_s against sodium alginate concentration.

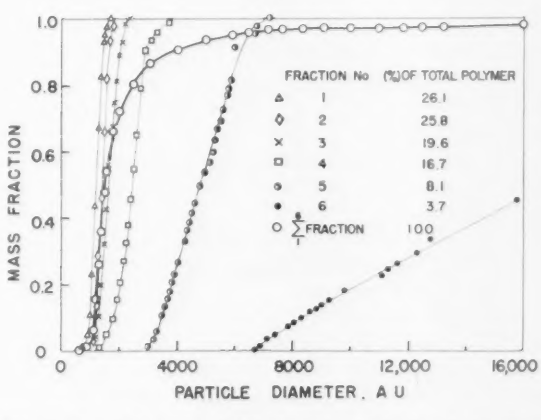

FIG. 3—Cumulative mass distribution of particle sizes in fractions of 2105 latex, batch II, and their summation.

The procedure for calculating the cumulative mass distribution of particle sizes from electron microscope examination of fractions is expressed formally:

i = the particle size group number, and assumes integral values from 1 to k.

j = the latex fraction number, and assumes integral values from 1 to n.

P_{ij} = the number of particles in the i'th group of the j'th fraction.

F_j = the weight fraction of the total polymer residing in the j'th fraction.

The fraction of the total mass residing in the i'th particle size group is then found by calculating

$$\sum_{j=1}^{n} \left[\frac{i^3 P_{ij} F_j}{\sum_{i=1}^{k} i^3 P_{ij}} \right]$$

Plotting the cumulative values of this expression for each value of i against particle size gives the cumulative mass distribution of particle sizes in the latex. The particle size is equal to $i \times d$ where d is the size of the group interval in Angstrom Units.

Data used in constructing the calibration curve of Figure 1 are obtained by determining alginate concentration and particle size corresponding to numerically equal values of weight fraction of polymer in a given latex from the curves of Figures 2 and 4.

Application of these procedures to each of the calibration latices provides overlapping portions of the calibration curve. The fact that the data from such a variety of latices, as used in this calibration, fall on a smooth curve lends weight to the necessary assumption that a given concentration of creaming agent creams substantially those particles which are above a certain size, regardless of the nature of the latex.

If particle size is plotted against the reciprocal concentration of alginate, the calibration curve can be approximated by a straight line defined by the expression $D = 223 + 117.7\ (1/C)$ where D = particle diameter in Angstrom Units, and C = alginate concentration in per cent on the aqueous phase.

This expression can be used instead of the calibration curve for estimating particle size, but with some loss of accuracy at the small particle end of the range.

Discussion

The experimental variables expected to affect the relation between particle size and creaming agent concentration are:

(1) Concentration of latex mixture.

(2) Electrolyte concentration and pH.

(3) Soap concentration.

(4) Creaming time.

(5) Properties of creaming agent solution.

Research shows latex concentration influenced effectiveness of the creaming agent. This behavior was indicated previously by Schmidt & Kelsey *(4)*. The magnitude of this effect decreases with decreasing latex concentration, and becomes acceptably small for concentrations of 2.5 per cent or less. The choice of 2.5 per cent latex solids as a standard concentration for fractional creaming is based on this observation.

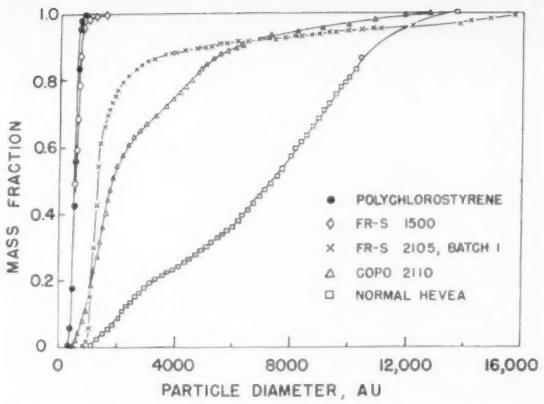

FIG. 4—Cumulative mass distribution of particle sizes in calibration latices.

Furthermore, effects of possible adsorption phenomena on concentration of the aqueous phase may be expected to be small at low polymer concentrations. Adsorption effects are assumed to be negligible in our treatment of the data. A lower concentration would have been advisable on theoretical grounds, but would have possibly complicated the determination of polymer content of the skim, because of the low ratio of polymer to non-polymer solids.

The effects of electrolyte content and pH were found sufficiently small so that variation in these factors, normally occurring in latex, had no significant effect on creaming. This observation has been confirmed in this laboratory by Adams *(6)*. However, the addition of buffers or other electrolytes should be avoided, since salt concentrations of about 0.02 N on the aqueous phase of the creaming mixture begin to shift the calculated distribution curve toward smaller diameter. When this concentration reaches about 0.05 N, the error becomes about 10 per cent. This salt concentration (Na_2HPO_4) represents a salt content of nine per cent of the latex solids, a quantity which is not likely to be met in practice.

The purpose of the soap added prior to dilution is to prevent coagulation on dilution, and to enhance the stability of the cream. The quantity of soap was found not to affect the creaming until a soap concentration of twenty parts per hundred polymer was reached, a level much higher than any likely to be met in practice.

The concentration of skim was found to remain essentially constant with time, despite the fact that the volume of the skim layer increases with creaming time. As a consequence, creaming time is not critical, provided that sufficient time is allowed for accumulation of enough skim so that the 20 to 40 gram sample for solids determination can be obtained without disturbing the boundary. Because of the high viscosity associated with high alginate concentrations,

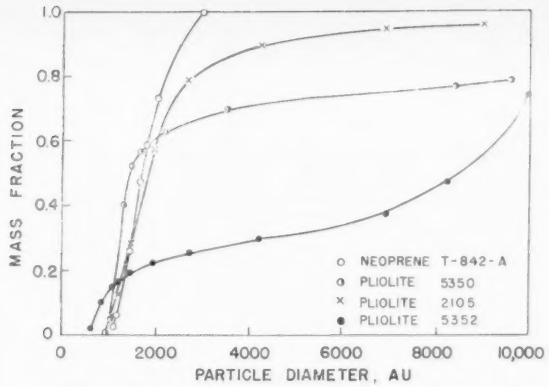

FIG. 5—Cumulative mass distribution of particle sizes.

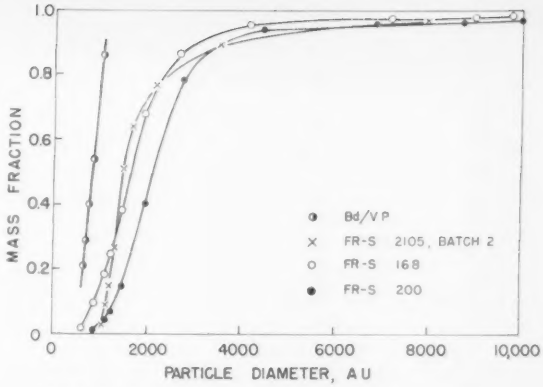

FIG. 6—Cumulative mass distribution of particle sizes.

time required under these conditions is greater than for low alginate concentrations. In any case, a minimum of 24 hours should be allowed for creaming. Creaming with alginate has been accelerated in a centrifuge by Maron *(2)* but this method was not used.

The nature of the sodium alginate employed as creaming agent is very important. Alginate solutions undergo bacterial decomposition on aging and creaming efficiency decreases as alginate becomes degraded. Therefore, preservation with sodium pentachlorphenate was adopted as standard practice. The preservative was found to introduce no specific effects of its own. The use of preservative, and storage of the solution under refrigeration, maintained constant creaming characteristics of the alginate for a period of at least one month. A decrease in viscosity of the alginate solution indicates decomposition, although a decrease of as much as sixteen per cent had no observable effect on the creaming. Two batches of Kelcosol were observed to differ 5 per cent in initial viscosity without affecting the creaming results.

A variety of materials other than alginates are known creaming agents for latex, but quantities required to produce the same effects vary with the nature of the material. Consequently, their use would necessitate the determination of a new calibration curve for each material.

Sodium alginate was selected because it is relatively efficient, and in contrast to ammonium salt, it avoids the volatile base which affects the calculation of polymer content. Furthermore, it is available in a refined grade for food and pharmaceutical uses.

The procedure for determining mass distribution of particle sizes in latex by fractional creaming has been applied to a number of latices of widely different characteristics, containing a variety of polymer types. Cumulative distribution curves for Pliolite 2105, Pliolite 5352, Pliolite 5350, Neoprene T-842A, FR-S 168, FR-S 200, and a Bd/VP latex are shown in Figures 5 and 6. All but the last are commercially available. The points lie on smooth curves, covering a range of particle sizes from 500 to 10,000 Angstrom Units. This represents the useful limits of the calibration curve. The extreme differences between the mass distributions are quite obvious, and should help account for some of the observed characteristics of the latices.

In Pliolite 5350 and 5352, a substantial portion of the mass comprises particles which exceed in size the upper limit of the method described here. Although the curves for these latices give the distribution of only that portion of the mass below 10,000 Angstrom Units they do determine quantitatively the mass of polymer above 10,000 A.U. Because of the low frequency of large particles in such latices of very wide particle size distribution, methods which depend on particle counting may give very inaccurate estimates of the mass in large particles, unless a very large number of particles is counted. If the mass in particles larger than a given size is uncertain, the distribution for particles below that size will be correspondingly uncertain. If the distribution above 10,000 A.U. is desired, another method is called for.

While the major objective of this paper is to present a method for determining mass distribution of particle sizes without the use of expensive equipment, it should be mentioned that if an electron microscope is available good use can be made of the incremental creaming procedure. This will greatly improve analysis of latices with wide distributions of particle sizes. An example is latex FR-S 2105 batch 1. Table III

TABLE III—COMPARISON OF NUMBER AND MASS DISTRIBUTIONS OF PARTICLE SIZES IN FR-S 2105

Particle Diameter Angstrom Units	Cumulative Mass of Polymer Above Size Indicated (%)	Cumulative No. of Particles Above Size Indicated (%)	Probability of Occurrence of Particles Larger Than Size Indicated
1000	94.0	85.0	0.85
1500	38.9	9.4	0.094
2000	24.3	1.87	0.019
3000	15.9	0.25	0.0025
4000	13.07	0.102	0.0010
5000	11.14	0.045	0.00045
6000	10.1	0.025	0.00025
10000	6.4	0.006	0.00006
18000	0	0	0

Derivation of Equations

Polymer Concentrations

Let: C_{pm} = concentration of polymer in creaming mixture (weight fraction of mix)

C_{ps} = concentration of polymer in skim (weight fraction of skim)

S_s = total solids of skim (weight fraction of skim)

S_m = total solids of mix (weight fraction of mix)

C_{aq} = concentration of solids in aqueous phase (weight fraction of aq. phase.)

$C_{aq} = (C_s + C_{uf} + C_{sa} + C_k)$ where

C_s = concentration of added soap,

C_{uf} = concentration of ultrafiltrate,

C_{sa} = concentration of Santobrite added in the Kelcosol, and

C_k = concentration of Kelcosol, all expressed as weight fractions of the aqueous phase of the total mixture.

By definition $(1-C_{pm})$ represents the amount of aqueous phase expressed as wt. fraction of the total mix.

Then: $C_{pm} = S_m - (1 - C_{pm})(C_{aq})$

rearranging:

$$C_{pm} = S_m - C_{aq} + C_{pm} C_{aq}$$

$$C_{pm}(1 - C_{aq}) = S_m - C_{aq}$$

$$C_{pm} = \frac{S_m - C_{aq}}{1 - C_{aq}} = \frac{S_m - (C_s + C_{uf} + C_{sa} + C_k)}{1 - (C_s + C_{uf} + C_{sa} + C_k)}$$

If the S_m is determined on a sample prepared with no creaming agent, (as is preferred) then $C_{sa} + C_k$ are zero.

Similarly:

$$C_{ps} = S_s - (1 - C_{ps})(C_{aq})$$

$$C_{ps} = S_s - C_{aq} + C_{ps} C_{aq}$$

$$C_{ps}(1 - C_{aq}) = S_s - C_{aq}$$

$$C_{ps} = \frac{S_s - C_{aq}}{1 - C_{aq}} = \frac{S_s - (C_s + C_{uf} + C_{sa} + C_k)}{1 - (C_s + C_{uf} + C_{sa} + C_k)}$$

where S_s is determined on the skim, and C_{sa} and C_k can not be zero. $(1 - C_{ps})$ is the aqueous phase expressed as weight fraction of the skim.

Per Cent Polymer Uncreamed

Let: W_m = weight of creaming mixture

W_{pm} = total weight of polymer

C_{pm} = concentration of polymer in mixture (weight fraction)

W_{pc} = weight of polymer creamed

W_s = weight of skim = $W_m - W_{pc}$ (by definition)

W_{ps} = weight of polymer in skim = weight of uncreamed polymer (by definition)

C_{ps} = concentration of polymer in skim (weight fraction)

$W_m - W_{pm}$ = weight of aqueous phase (by definition)

Then: $W_{ps} = W_{pm} - W_{pc}$

$$\frac{W_{ps}}{W_s} = \frac{W_{ps}}{W_m - W_{pc}} = C_{ps}$$

$$W_{ps} = C_{ps}(W_m - W_{pc}) = C_{ps}(W_m - W_{pm} + W_{ps})$$

$$W_{ps} = C_{ps} W_m - C_{ps} W_{pm} + C_{ps} W_{ps}$$

$$W_{ps} - C_{ps} W_{ps} = C_{ps} W_m - C_{ps} W_{pm}$$

$$W_{ps}(1 - C_{ps}) = C_{ps}(W_m - W_{pm})$$

$$W_{ps} = \frac{C_{ps}(W_m - W_{pm})}{1 - C_{ps}}$$

$$\frac{W_{ps}}{W_{pm}} = \frac{C_{ps}(W_m - W_{pm})}{W_{pm}(1 - C_{ps})}$$

$$\frac{W_{ps}}{W_{pm}} = \frac{C_{ps}(W_m - W_{pm})}{W_m C_{pm}(1 - C_{ps})} = \frac{C_{ps} W_m (1 - C_{pm})}{W_m C_{pm}(1 - C_{ps})} = \frac{C_{ps}(1 - C_{pm})}{C_{pm}(1 - C_{ps})}$$

Therefore, the uncreamed polymer (as a weight fraction of the total polymer) is given by:

$$\frac{C_{ps}}{C_{pm}} \times \frac{(1 - C_{pm})}{(1 - C_{ps})}$$

indicates the relative frequency of occurrence of particles of various sizes. Ten per cent of the mass occurs in particles over 6,000 Angstrom Units, but the probability of finding a particle larger than 6,000 Angstrom Units in a single observation is 0.00025 when examining the unfractionated latex. If the large particles are isolated and concentrated by fractional creaming, the mass distribution of these large particles can be determined satisfactorily by counting a few hundred particles. The upper end of the mass distribution curve thus can be based on a particle count that contains almost the same number of particles as other portions of the curve. To obtain equivalent representation of large particle sizes in unfractionated latex obviously requires counting many particles.

Although this paper deals with mass rather than number distributions of particle sizes, the number distribution can be calculated once the mass distribution is known. Therefore, the method described here should be of use to those engaged in research on the theory of emulsion polymerization as well as to the latex technologist.

It is the hope of the authors that use of these procedures will make available to a greater number of laboratories the acquisition of particle size data which might be of value in the study of many latex problems.

Acknowledgements

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EDITORIAL

Season's Greetings

For all molders and extruders
For all coaters and denuders

For each and every masterbatcher
For each proofer, color matcher

For every rubber pulverizer
For each and every vulcanizer

For those who work with mats or slippers
For engineers and latex dippers

For carbon black men, lab technicians
For tensile testers—electricians

For deflashers, packers, grinders
For vinyl foamers, wire winders

For rackers, stackers, cement mixers
For slitters, slicers, repairers, fixers

For each of you—in every way—

A Merry, Merry Holiday!

Records and Valuations

By W. Y. ARMSTRONG
American Appraisal Company
Milwaukee 1, Wisconsin

► Plant property and equipment loom large on the balance sheets of the nation's rubber companies. On the basis of original cost, and excluding leased equipment, these two items represent 66 per cent of total rubber industry assets, and their yearly scheduled depreciation is roughly 135 per cent of annual dividends paid.

The magnitude and upward trend of these figures, coupled with rapidly shifting technology and costs and increasingly sophisticated production methods, make the sensitive and continuous maintenance of property records and property valuations a crucial task for rubber's management. This is a multi-dimensional task that touches several phases of executive responsibility.

(1) Property Custody. As custodian of shareholders' investment, management is charged with knowing what property has been acquired, where it is located, and its character and condition. Although this seems a relatively simple matter, it becomes complex in large plants and in companies with multi-plant operations. Property custody becomes more sensitive with liability exposure on leased equipment, or in cases in which management functions as trustee for property investments made from pension funds.

Although the specifications for records may vary considerably from a detailed inventory of all real and personal property to one of broad descriptive content, the fundamental element in good property custody is record keeping executed with intelligent care and with a degree of accuracy compatible with the objectives sought.

(2) Insurance Records and Valuations. Parallel to the identification of property for custody purposes is the recording and valuation of property for determination of proper levels of insurance and the effective implementation of the insurance program. A typical insurance contract, for example, provides that in the settlement of loss, the insured must ". . . furnish a complete inventory of the destroyed, damaged and undamaged property showing in detail quantities, costs, actual cash value and amount of loss claimed . . . and if required, verified plans and specifications of any buildings, fixtures or machinery destroyed or damaged."

In determination of actual cash value, the current cost of reproduction (not original cost) less depreciation is a basic consideration. This demands that for successful and unassailable proof of loss, property records must be available that show each insured item or group of items appraised at current reproduction costs and cost of reproduction less depreciation. A continuous appraisal of company property that is grounded in a knowledge of the equipment or structure, current prices and reproduction costs, including assembly and installation, and extent of depreciation, is clearly required.

Although more and more rubber companies are using agreed amount forms of insurance, some policies have other provisions. A replacement cost endorsement or a coinsurance clause, for example, require adequate valuation data. The coinsurance clause is a surprisingly misunderstood and misused provision. It normally reads:

Coinsurance Clause

"The insurance company shall be held liable for no greater proportion of any loss than the amount hereby insured bears to 80 (or 90) per cent of the actual cash value of the property described herein at the time when such loss shall happen."

Under this clause, it is the responsibility of the insured to determine the

actual cash value of the entire property for the establishment of coverage and premiums. Should the insured fail to maintain a proper level of coverage, he is penalized in any loss settlement to the extent of any deficiency in his compliance. For example, if according to the actual cash value of the property at the time of loss and terms of the coinsurance clause, $100,000 of insurance should have been carried but only $50,000 was carried, the property owner will be indemnified only to the extent of $50,000/$100,000 or one half the actual cash value of the property destroyed or damaged.

Obviously neither the replacement cost endorsement clause nor the coinsurance clause can be completely complied with unless the value of the property is known at all times. To make the insurance 100 per cent effective, the property owner must have a set of property records from which he can obtain at any time the location, quantity, identification, and actual cash value of each unit, any group of property, and the total property.

In short, the protection afforded by coverage is made complete and operative by appropriate records and valuation data. In the place of such data, the accounting department's original cost ledger sheets or retrospective guesses made after loss weaken the fabric of protection.

(3) Valuations for Accounting. The accounting function of property records is considerably more complex and is essential to effective coordination of plant, investment, production and pricing. This phase embraces management review of property valuation data for controlling costs, relating costs to prices, reckoning investment yield, and establishing current value in weighing the inadequacy of depreciation on original costs. Some companies use such data as a basis for determining the extent to which earnings shall be paid as dividends or retained to offset the impact of rising replacement costs. As with records and valuation administration for insurance purposes, the key to realistic accounting control of property is the forthright recognition of the difference between accounting for dollars and accounting for things.

(4) Valuations for Other Purposes. Once prepared, the property records can be used for financing, for determining future cash requirements for replacements, for the defense of positions taken in tax returns and taxation negotiations, in corporate reorganization and mergers, and in programing repair, maintenance, replacement and disposal schedules. Although the form and content of records for each of these purposes may vary, these valuation uses depend initially upon the adequacy of property records.

In accomplishing the goals of sound practice in property management, an inventory of all realty and personalty is first required. This inventory must be based on the property in existence and not on just an analysis or development of an inventory from accounting records.

Control of Property

In identifying property, a realistic recognition must be made that some types of property cannot be controlled, whereas others constitute controllable items. Examples of controllable units would be Banbury mixers, mills, or tire making machines. Non-controllable property would include piping, wiring, factory hand trucks, racks and small tools. The problem is best met by defining the concepts of controllable and non-controllable property at the outset. These definitions should be phrased in terms of the varying applications intended for the property records.

Once a property inventory is prepared, it may be transcribed in any one of a number of forms, depending again upon the objectives and application sought. In some cases, plant ledger sheets alone are appropriate; in others, mechanical tabulating cards serve a useful supplementary role. The decision as to method depends upon the detail sought, the number of repetitive units, the total number of items, and the velocity of property changes.

Content of Records

Regardless of the method used in recording, the content of property records may vary also with the intended application of the records. At a minimum, the records should contain descriptive and location data, costs as expended and as indicated by accounting records, useful life, and depreciation data. In more intensive record keeping, the system should incorporate price adjustment factors to meet the requirements of return on investment, current value concepts, and insurance valuation coverage figures. This can be accomplished through an analysis of the price fluctuation characteristics of the recorded property items and through development of codes to adjust for such changes in price levels.

Many property records, even though properly prepared at first, deteriorate through lack of proper perpetuation. An important tool in perpetuation is the development of a property records manual for both management and the operational personnel. The manual should record the principles of property records and valuation, their uses and applications, methods of policing, and precise instructions for systems management. This becomes particularly important in multi-plant operations that do not have centralization of administration.

In perpetuation, there must be periodic verification between records and actual property. Through verification, unreported deductions and unreported transfers are spotted, items expensed are brought back into the property records for insurance purposes and there is control on the effect of technological changes on remaining useful lives as a basis for more factual depreciation recovery.

In constructing a records system, attention must be given to the intended application of the recorded data. For example, accounting requirements may call for location of machinery and equipment by departments or process centers, whereas insurance requirements demand location by buildings and floors. In addition, insurance calls for exclusion of certain classes of assets such as underground foundations, building foundations, machinery mountings, underground tunnels, and piping; accounting, on the other hand, would include these items as depreciable assets.

Card Coding

Despite the varied requirements of the records and valuation system, the separate functions of property records do not necessarily demand separate and partially duplicated card decks or plant ledger sheets. Through card coding, for example, most records can be collapsed into a single deck and a field of columns assigned for each of the separate records functions. When a shorter run is made, the deck can be cleared of all items inappropriate to the analysis in progress. The use of memory circuits expands the opportunities for analysis.

With shifting technology and costs and rising ratios of equipment inputs, records and valuation administration become increasingly essential tools in effective management in the rubber industry. The records system is necessarily multi-dimensional, and should be devised to accommodate the requirements of property custody, insurance, accounting, taxation, and other functions. If properly constructed, the records system must be based on an inventory and appraisal of plant equipment through on-site inspection, rather than through accounting records. To be effective once prepared, the system must be verified and adapted on a sustained, continuous basis.

RMA Holds 45th Annual Meeting on November 17th in New York City

► A review of the rubber supply-demand outlook, a report on business trends and the economic outlook for 1961, a panel discussion on foreign trade and our trade policy, and an address on the 1960 elections, were heard by the more than 200 rubber industry executives attending the 45th Annual Meeting of the Rubber Manufacturers Association on November 17 at the Essex House, New York, N. Y.

Morning speakers were Dr. R. P. Dinsmore, research vice-president of the Goodyear Tire and Rubber Co., Akron, Ohio, who spoke on "The Battle Between the Tree and the Test-tube," and Dr. Roy L. Reierson, vice-president and chief economist of the Bankers Trust Company of New York, whose topic was "The Dollar: Top Priority for 1961." Participating in the foreign trade panel, "World Trade — Spur or Brake on U. S. Economy?" were: Charles P. Taft, general counsel of the Committee for a National Trade Policy; H. B. McCoy, president of the Trade Relations Council; and C. P. McFadden, chairman of the Footwear Division of the Rubber Manufacturers Association. Mr. McFadden was moderator. The luncheon speaker was Dr. Claude Robinson, founder and chairman of Opinion Research Corporation of Princeton, N. J. who presented "An Interpretation of the 1960 Elections." Other events were a 9:15 a.m. business meeting and a noon reception for all rubber manufacturers. The welcoming address was delivered by Ross R. Ormsby, president, Rubber Manufacturers Association.

In his speech on "The Battle Between the Tree and the Test Tube," Dr. Dinsmore declared that "It is no longer a question of whether synthetic can be used in place of natural rubber to give adequate quality. The question now is simply one of economics." He pointed out that natural rubber now has a test tube counterpart in the form of the new "stereo" synthetic rubbers, the most promising of which are, he said, *cis*-1,4 polyisoprene and *cis*-1,4 polybutadiene. Citing polyisoprene as the test tube equivalent of natural rubber, he also expressed his opinion that polybutadiene can replace natural in about half of natural's uses.

R. P. Dinsmore

He said that combined production capacity of polyisoprene and polybutadiene in the United States is expected to leap from 5,000 long tons in 1960 to 370,000 long tons by 1965, and that production abroad—with the exception of the Soviet Bloc—is expected to mount to 180,000 long tons by 1965 — from zero in 1960.

The new stereos, he said, must compete with natural rubber in a future world market which may stabilize at 25c a pound or less—perhaps 18 to 20c a pound, the price goal for the stereos depending on developing cheap starting materials and economic processing methods. The market price of natural rubber over the next few years will be strongly influenced not only by the requirements of the free world, but also by the purchases of the Soviet Bloc. If the purchases of the Soviet Bloc continue at approximately their present level, the projected production of stereo rubber will be needed to keep the natural rubber position in balance, he stated. "Over the past decade, the policy of the synthetic rubber manufacturers has been to establish a moderate price and hold to it in spite of the fluctuations of the natural rubber market," he commented. "This policy has proved sound, and it looks as though the contrary marketing system of the natural product is once again permitting and encouraging the expansion of the synthetic industry, and this time on a quality level that is directly competitive."

Mr. Dinsmore found that little present prospect exists that stereos will completely displace natural rubber. Newly developed strains of high yielding rubber trees and methods of increasing production of the trees by use of such stimulators as hormones have been developed, offering promise that some rubber growers may improve yields to "a point where large quantities of rubber may be produced at a cost quite competitive" with the lowest-cost stereo rubbers, he said.

In speaking on "The Dollar: Top Priority for 1961," Dr. Roy L. Reierson, vice president, Bankers Trust Co., stressed current attacks on the United States dollar, its recent weakness in foreign trade, and the fact that gold has been leaving the country in record amounts. He compared the present financial situation to the recession of 1958 saying that "the recent rate of gold outflow, however, has exceeded even the worst weeks of 1958. . . . " Broadening the comparison, he stated that by the middle of this year "Pressure on the dollar was intensified by the sag in business, which brought fears of further credit ease and large Government deficits. But, Dr. Reierson went on to show the brighter side of the picture: "Actually, we have sufficient resources to weather the current wave of questioning and speculation against the dollar. Despite the gold losses of recent years, the United States gold stock is not only greater by far than that of any other country, but exceeds by a significant margin the gold reserves of the European Common Market countries plus Britain, Canada and Switzerland combined."

Balance of Payments

The speaker went on to underline his major point: "Underlying these anxieties concerning the dollar, however, is the large and persistent deficit in our balance of payments. After averaging around $1.5 billion through the first half of the 1950's, the deficit has increased to more than twice as much in recent years. The developments of recent weeks have performed a useful service in that they have once again, and with greater emphasis than ever, directed attention to the urgent need for redressing the imbalance in our international accounts and restoring world confidence in the dollar," Dr. Reierson said.

The speaker cited several methods of easing the strain, among them an attempt to combat "the drain on the United States gold stock by rendering aid through greater exports of goods and services rather than by making dollars available that may be spent anywhere in the world"; he also suggested a need for energizing American competition in world trade. On the way to rebuilding confidence he suggested that "nothing could contribute more to the restoration of confidence in the dollar than concrete evidence that the new Administration intends to keep the Federal budget under control, preserve the independence of the Federal Reserve, and refrain from curtailing the exercise of a flexible credit policy." In conclusion he called for a restudy of the mechanism of international settlements under the international gold standard as it is now in effect in the free world economy.

Seen, left to right, at the 45th Annual RMA meeting, are C. P. Taft, C. P. McFadden, H. B. McCoy, and R. R. Ormsby.

Mr. H. B. McCoy, president, Trade Relations Council, as a panelist on World Trade, urged a "live and let live" trade policy within the limits where it would not injure either U. S. or foreign industry. "Following this policy, now prevalent in most other countries, would provide ample opportunity for orderly trade expansion, but would not depress our economy. It would benefit all participants and injure none." Mr. McCoy sharply attacked proposals that the Federal government's main approach to the problem of import injury should be to assist industries and localities to adjust after the injury has occurred. A completely unrestricted trade policy relying only on such governmental aid "would be very destructive to our national economy and should be rejected in toto." He cited currently increasing U. S. investments abroad, stimulating production overseas of goods we ordinarily export, as a recognition that "our long time favorable competitive position has all but disappeared."

Charles P. Taft, general counsel of the Committee for a National Trade Policy, the second panelist, urged that the United States move forward in its trade policy toward a greater reduction of barriers to international trade among the countries of the free world. He criticized "proposals that have been made for a general system of import quotas to maintain a so-called 'reasonable' level of operations for basic American industries" as "retrogressive and self-defeating," seeing in them only a way of relieving the industries concerned of "the necessary adjustments which world competition imposes." Such a course, he warned, "would be clearly inflationary, and would go far to deny us the economic and political leadership which our position in the world demands we maintain. . . . To advocate such a system is a counsel of despair. It clearly suggests that we have lost our vigor and our competitive capacity and must therefore withdraw from the competitive world."

The luncheon speaker, Dr. Claude Robinson, founder and chairman of Opinion Research Corporation of Princeton, N. J., delivered "An Interpretation of the 1960 Elections," discussing and interpreting the mandate resulting from the election, in terms of public opinion pressures.

Three new RMA directors were elected at the meeting. They are: George R. Vila, M. G. O'Neil, and I. H. Hoffman.

W. A. Suiter

Rhoda M. Stewart

Marbon Appoints Vice-Presidents

► William A. Suiter and Rhoda M. Stewart have been appointed vice-presidents of the Marbon Chemical Division of Borg-Warner Corp., Washington, W. Va. Mr. Suiter has served as Cycolac resin sales manager since he joined Marbon in 1958. He was formerly assistant sales manager of molded products at the Panelyte Division of the St. Regis Paper Co., Richmond, Ind. In his new capacity at Marbon he will be responsible for all product sales activities, including rubber resins, latex and adhesives.

Miss Stewart has served as director of purchases. Earlier this year the Traffic Department was added to her responsibility, and now she will also assume responsibility for the direction of the Personnel Department.

Dow Establishes Unit

► The Dow Chemical Co., Midland, Mich., has announced the organization of a specialized unit to handle urethane chemical sales. The new group is intended to provide concentrated service in depth on polyglycols and derivatives for resilient foams, rigid foams and elastomers, to the comfort cushioning, refrigerator, rubber, automotive, boat and construction industries. Robert E. Ten-Hoor, former head of the Polymers Chemicals Section of the Technical Service and Development Department, will be manager of the new unit. Dow has also announced that it will market a line of urethane chemical products, including the Voranol series of seven basic polyethers for flexible and rigid foams, under the trade name Vorane. The Voranate R series of isocyanate adducts, developed to provide versatility in producing cellular urethane for foamed-in-place rigid systems, will round out the line.

Copolymer Adds Unit

► A 95,000 square foot concrete warehouse has been completed and is now in use at Copolymer Rubber and Chemical Corp., Baton Rouge, La. The three section building is designed to permit future expansion. It is of fire-resistant, weatherproof concrete construction, and is connected to previously existing storage facilities by two weatherproof, fire-resistant crossover tunnels which can be sealed by automatic doors in case of fire. Facilities in the warehouse provide for seven truck platforms, and 150 feet of rail siding for freight cars.

Cyanamid Section Moves

► The Petrochemicals Department of American Cyanamid Co. has moved its headquarters to Bound Brook, N. J., from New York City. The company expects to have division headquarters established at the Bound Brook location by mid-1961.

Quebec Group Hears About Nitrile Rubber

► "Modern Nitrile Rubber Technology" was the subject of the talk presented by H. H. Pfisterer (Polymer Corp.) at a technical meeting of the Quebec Rubber & Plastics Group, held on October 20 in Montreal, Quebec, Canada. In his remarks, Mr. Pfisterer dealt with five subjects: (1) the introduction of "cold" nitrile rubber; (2) the introduction of cross-linked nitrile-butadiene rubber; (3) the revival of interest in nitrile rubber/polyvinyl chloride blends; (4) current techniques for compounding nitrile rubbers for heat resistance; and (5) the improvement in the color properties of some nitrile rubbers. Mr. Pfisterer devoted a considerable portion of his talk to current techniques for compounding nitrile rubbers for heat resistance. He reported on compounds which can be used in dry heat at temperatures up to 250°F., and in unmodified petroleum oils at temperatures in excess of 300°F.

American Rubber Builds

► The recently formed American Rubber and Chemical Co., a joint venture of Stauffer Chemical Co., New York, N. Y., and American Synthetic Rubber Co., Louisville, Ky., has awarded a semi-works facility contract to Crawford and Russell. American Rubber had previously made the announcement that it will build a multi-million dollar plant at Louisville, Ky., for the production of polybutadiene and polyisoprene synthetic rubbers under processes licensed by Phillips Petroleum Co. The semi-works plant, for the development and limited production of new synthetic elastomers and rubbers, will be located next to the new production facility which is scheduled for completion in September 1961.

International Latex Tylac

► International Latex Corp., Dover, Del., has introduced Tylac 3040, a modified butadiene-styrene latex of the self-curing type intended for textile, carpet, upholstery and rug applications. The product is a non-staining antioxidant with synthetic anionic emulsifier. Viscosity is 50 to 70 cps., and chemical stability is reported by the company to be good. The latex is clear, and total solids content is approximately 49 per cent.

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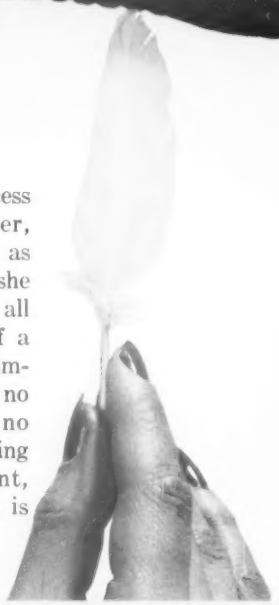

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New Polymer Group Formed in Texas

► The formation of a Polymer Chemistry Group, affiliated with the Southeastern Texas Section of the American Chemical Society, was accomplished at a meeting held on November 15 in Houston, Texas. G. W. Daues (Monsanto) was elected chairman of the group. Other officers elected were: *Chairman-Elect*, Dr. W. R. Peterson (United Carbon); *Secretary*, Dr. H. B. Johnson (Petro-Tex); *Treasurer*, Allan B. Craig (Witco); and *Directors*, H. J. Lochridge (Diamond Alkali) and Dr. W. G. DePierri (Humble Oil & Refining).

Chairman Daues stated that the objectives of the group are to foster the exchange of ideas, establish educational programs to keep pace with the rapid technological advances, and to promote polymer chemistry in all aspects. According to Mr. Daues, membership in the new group is open to all members of the Southeastern Texas Section of ACS, and the group has 61 charter members representing 27 Gulf Coast companies.

At the formation meeting, Prof. Murray Goodman (Polytechnic Institute of Brooklyn) addressed the group on the subject "Influence of Polymer Stereochemistry on Properties."

Biggs Purchase Told

► Biggs Steel Foundry and Fabricating Co., Akron, Ohio, has been purchased by the United Sheet Metal Co., Inc., Columbus, Ohio, and will continue to operate as the Biggs United Division of United Sheet Metal. The company was formerly a subsidiary of Union Spring and Manufacturing Co., New Kensington, Penna. Key personnel will remain to form the nucleus of the new organization. James R. McGill, president of United, has indicated that an extensive modernization program is slated for the Akron plant over the next few years.

Polyfoam Changes Name

► The name Spectrafoam Corporation has been registered as the new name for Polyfoam Products Co., Los Angeles, Calif. The company has changed its name in line with an agreement with General Tire and Rubber Co., Akron, Ohio, which had disputed the use of the name "Polyfoam." The company will continue under the same management.

C. J. Harrington

L. E. King

DuPont Promotes Harrington and King

► Dr. Charles J. Harrington has been appointed assistant general manager of the Elastomer Chemicals Department of E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., to succeed Ernest R. Bridgwater who will retire at the end of the year. Lyle E. King, assistant director of sales, has been named to succeed Dr. Harrington as director of sales. Both appointments are effective January 1. Dr. Harrington graduated from Princeton University with a B.S. degree in chemical engineering in 1933. He has been with DuPont since that time, starting as a chemist in the Jackson Laboratory of the Organic Chemicals Department at Deepwater Point, N. J. He interrupted his career to take postgraduate studies at the Massachusetts Institute of Technology, receiving a Doctor of Science degree in chemical engineering in 1938.

In 1941 he joined the staff of the neoprene plant then being organized at the Chambers Works, and between 1941 and 1945 he held supervisory positions at various plant locations. From 1945 to 1948 he held a staff position at the Louisville Neoprene Works. In 1948 he was transferred to the European office of the Foreign Relations Department, London, England, as technical representative, and he became manager of the office later the same year. He was appointed an assistant secretary of the company and assistant director of the Secretary's Department in 1952, returning to Wilmington. In 1954 Dr. Harrington was transferred to the Rubber Chemicals Division of the Organic Chemicals Department, and in 1957, he became sales director of the newly formed Elastomer Chemicals Department.

Mr. King, who received a B.S. degree from the University of Nebraska in 1943, started with DuPont in 1946 in the Engineering Department and was transferred to engineering work in the Photo Products Department in 1948. In 1949 he became an associate economist in the Economist's Office, and in 1955 he was transferred to the Organic Chemicals Department as manager of market research in the Rubber Chemicals Division. He was named manager of the Planning Division of the Elastomer Chemicals Department in 1957 and in 1958 he became sales manager of elastomers. In 1959 he was named assistant director of sales.

Armstrong Expansion

► Armstrong Products Co., Warsaw, Ind., has reported that its $100,000 expansion program, including a 5,000 square foot factory building which will double production capacity, is nearing completion. The new factory building will house production facilities for the epoxy resin adhesives and and epoxy resin coating materials produced by the company, as well as equipment for its application, made and marketed by an affiliate company, Armstrong Resins, Inc.

Natural Rubber Delegates Visit Research Institute

► Over 250 delegates from all parts of the world attended the Natural Rubber Research Conference at the headquarters of the Rubber Research Institute of Malaya, Kuala Lumpur, from September 28 to October 1. The conference program events were reported in the November, 1960, issue of RUBBER AGE. These four photographs show delegates touring the facilities of the Rubber Research Institute of Malaya in Kuala Lumpur.

Dr. G. A. Watson (Rubber Research Institute of Malaya) explains a bud graft experiment to conference delegates visiting the Institute's experiment station.

W. G. Wren (facing camera), director of the Chemical Division of the Rubber Research Institute of Malaya, discusses new testing procedures with M. P. Compagnon (Viet-Nam) and Dr. R. Hublin (France).

Observing experiments involving bacteria in latex are, left to right: Mr. Rennie and Dr. C. Bright (Liberia); P. Richard (Viet-Nam); Milton Gorgla and Dr. Eisen (Liberia), while B. Sekher (Rubber Research Institute of Malaya) explains.

Dr. Templeton (Rubber Research Institute of Malaya), at left, discusses the propagation of rubber from cuttings with, left to right, Ralph Wolf (Natural Rubber Bureau, Washington) and I. H. Duckworth (Malayan American Plantations).

Rubber Items Included In Space Equipment

► "Rubber products, used extensively in commercial industry and government, will definitely be a part of the spaceman's equipment," states Lt. Col. Albert A. Taylor, U. S. Air Force bioastronautics food expert, in his recently completed book - form report on "Food for Space Travel." Col. Taylor's report gives primary consideration for the spacemen and presents a complete program for providing food and water for manned space flights of durations of three days to several months.

"During flights which are of sufficient duration to require food," Col. Taylor wrote, "the astronaut will travel alone in a biopack (the capsule which includes all systems necessary to maintain life and the man). A storage department for food, water and small items of equipment will be necessary."

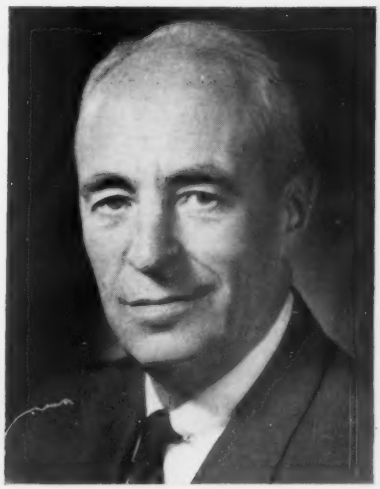
Rubber bladders and rubber gaskets will be used in the water solution storage section of the biopack. Water will be stored in a lightweight metal or plastic tank. A rubber bladder, inflated by means of a hand pump, will be provided for emptying the tank.

"Weight by volume can be minimized," Col. Taylor points out, "by use of materials such as rubber, plastics and aluminum. Formulation of feeding programs using lightweight equipment is based on flight feeding requirements; the experience of crews who have flown high altitudes, high performance aircraft, and those who have made high altitude balloon flights; as well as a variety of laboratory studies."

ASTM Definitions

► ASTM D-1566-60T, which includes the tentative definitions for the terms "rubber" and "rubber product," has been accepted for publication by the Administrative Committee on Standards of the American Society for Testing Materials. The recommendation was made by Committee D-11 on Rubber and Rubber-like Materials. Of three definitions submitted by Committee D-11, the administration accepted two, the definitions for rubber and rubber products, as tentative, with the understanding that they would receive prompt review for improvement by the Committee. The definition for "rubber-like" was referred back for further consideration by Committees D-11 and D-20.

Louis Cabot



Thomas Cabot

Cabot Corporation Elects President

► Louis W. Cabot has been elected president and chief executive officer of Cabot Corporation, Boston, Mass., succeeding his father, Thomas D. Cabot, who has been elected chairman of the board of directors. The company has also elected a new treasurer, William S. Edgerly, and three new directors, McGeorge Bundy, William L. Loving and John M. Bradley. Ralph Bradley and Henry L. Shattuck were named directors emeritus.

Louis W. Cabot holds a B.S. in engineering science and a masters degree in business administration from Harvard University. He joined the company after World War II and after working in various capacities in the Southwestern Division, he helped organize the company's first overseas venture, spending three years in England during the construction of the Stanlow plant as the first managing director of Cabot Carbon Limited. In 1951 he returned to the home office as assistant to the executive vice-president and in this capacity helped organize Cabot Carbon of Canada Ltd. Two years later he was elected vice-president and treasurer of the parent company and its subsidiaries, the position he has held until now.

Thomas D. Cabot, the new chairman of the board, joined the firm in 1919. He led the company his father founded into many new channels and guided the organization through its greatest period of growth and through its international expansion.

Mr. Edgerly, who received his B.S. degree from Massachusetts Institute of Technology and his masters degree in business administration at Harvard, joined Cabot in 1952 as staff assistant in the Economics Department. In 1955 he became administrative assistant to the manager of the Oil and Gas Division of Cabot Carbon Co., and a year later, he became assistant to the treasurer of the parent company. Early this year he was made assistant treasurer and placed at the head of the Finance Department.

WRG Installs Officers

► The newly-elected 1960-1961 officers of the Washington Rubber Group were installed during the group's Fall Meeting on October 26, 1960. The featured speaker at the meeting was John W. Steeves, deputy assistant secretary, Bureau of Far Eastern Affairs, Department of State. The subject of Mr. Steeves talk was "United States Role in the New Order in Asia."

Officers installed at the meeting were: *President*, Philip Mitten (U. S. Army Engineers R&D Lab); *Vice-President*, Thomas A. Tharp (General Tire); *Secretary*, Dan Pratt (Bureau of Ships); *Treasurer*, George Ritchie (National Bureau of Standards).

Earle S. Ebers

Dudley Chittenden

U.S. Rubber Promotions Announced

► Earle S. Ebers has been named group vice-president in charge of the polymer, fiber and chemical operations of the company and Dudley Chittenden has been named a vice-president and general manager of the company's Naugatuck Chemical Division, by the board of directors of the U. S. Rubber Co., New York, N. Y. In his new post Mr. Ebers will be responsible to the president for the operations of the company's textile, plantation and Naugatuck Chemical divisions as well as Latex Fiber Industries, Inc., a subsidiary.

Mr. Ebers received his B.S. degree in chemistry from Dalhousie University in Halifax, Canada. He joined the company in 1937 as a research chemist in its general laboratories. He was appointed manager of plastics development for Naugatuck Chemical in 1946, and three years later he became manager of Kralastic and Vibrin plastics sales, rejoining the Development Department as manager in 1949. Six years later he was named general sales manager for Naugatuck Chemical, and in 1956, assistant general manager. He was elected vice-president of the company and general manager of the Chemical Division in 1957.

Mr. Chittenden holds B.S. and Ph.D. degrees in chemical engineering from Yale University. He joined the company in 1926, also starting in the general laboratories as a research chemist. After serving at this laboratory and at the Development Department of the company's general products plant at Providence, R. I., he was assigned to Naugatuck Chemical's Development Department in 1941, becoming manager of this department in 1945. In 1950 he was transferred to the Production Department of the division, and named factory manager of the vinyl resin plant at Painesville, Ohio. In 1955 he was appointed production manager for the division. In 1958 he became manager of Marvinol vinyl operations, supervising research and development, production and sales of the division's vinyl resins.

Hits 4 Billion Mark

► Four billion pounds of synthetic rubber have been produced by the Houston, Texas, plant of the Goodyear Tire and Rubber Co., with the final billion pounds of Plioflex rubber turned out in only 23 months. By contrast, nearly seven and a half years was required to turn out the plant's first billion pounds. According to Russell DeYoung, Goodyear president, 500 rubber plantations of 2,000 acres each with an average annual yield of 500 pounds per acre would be required to obtain a billion pounds of natural rubber in a two-year period.

DuPont To Make Neoprene in Japan

► A new jointly owned Japanese company, Showa Neoprene K.K., to manufacture and sell neoprene synthetic rubber, will be formed by E. I. du Pont de Nemours & Co., Wilmington, Del., and Showa Denko K.K., Tokyo, Japan. A new Far Eastern Division has been formed by the International Department of DuPont to be concerned with the company's marketing and manufacturing activities in this area and the development of new business opportunities in the Far East. Dr. Robert E. DeRight, director of the Latin American Division, has been appointed director of the new division.

Final plans are being completed in Japan by Showa Denko K.K. and DuPont for the formation of the new Japanese company. Approval has been granted by the Japanese Government for the company in which the stock will be owned equally by Showa Denko and DuPont. Both companies will contribute capital to the new corporation. DuPont will also contribute process information and consulting services for the design and construction of an 18 million pound per year plant and for the training of personnel for its operation. Showa Denko, one of the largest chemical companies in Japan, will contribute extensive experience in Japanese manufacturing, and personnel to staff the new company. It is anticipated that the new plant will be located in Kawasaki at a site adjacent to an existing Showa Denko facility. Construction is expected to begin before the end of 1960.

Goodrich Silvertown Tire

► Development of a first-line tire said to feature a unique tread pattern and a re-location of the rubber designed to give as much as 25 per cent more wear has been announced by the B. F. Goodrich Co., Akron, Ohio. According to the company, the new tire, called the B. F. Goodrich Silvertown, uses the same amount of rubber as previous first-line treads, but on the new tire the center rib of the tread has been eliminated and the rubber saved has been added to the outside ribs where the load and wear is most concentrated. The tire is made with improved Tyrex cord and comes in passenger car sizes, tubeless, in white or black sidewalls.

Boston Group Hears Catton and Perlberg

► Over 150 members and guests attended the October 14 technical session of the Boston Rubber Group, held at the Somerset Hotel in Boston, Mass., and heard Neil L. Catton (DuPont) discuss "A Practical Method of Classifying All Elastomeric Vulcanizates," and S. Everett Perlberg (Adamson United) speak on "Modern Mill Room and Calender Facilities." Mr. Catton informed the session that such groups as ISO/TC 45, ASTM Committee D-11 on Rubber and Rubber-Like Materials, the Technical Committee on Automotive Rubber, and special groups working in the interests of the U. S. Department of Defense are all striving for the same goal, that is, to provide a workable system to classify and describe a wide range of qualities of commercially available elastomeric products.

Mr. Catton described an expanded tabular system which provides flexibility in respect to elastomers, quality levels, and methods of test. According to the speaker, guidance to the consumer in helping him to avoid specifying impossible or impractical combinations, and indications of those quality levels which are commercially available, are provided by the tables in the system. Mr. Catton informed the group that work in the Technical Committee on Automotive Rubber is progressing toward the adoption of this system since it has the flexibility necessary to satisfy the requirements of the U. S. Department of Defense.

In his presentation on mill room and calender facilities, Mr. Perlberg discussed new designs and applications of mills, new mixing techniques, calender design and application, and a comparison of the Intermix and Banbury. Basing his remarks around the gain in efficiency which can be accomplished by proper utilization of new and existing equipment, the speaker developed several thoughts which showed that improved efficiency also tended to improve quality standards of finished products.

Mr. Perlberg indicated that automation of mill room equipment was one possibility for large rubber manufacturers but problems of small rubber manufacturers with frequent batch changes mitigated against too much automation. He concluded his talk with a brief review of different types of calenders.

William H. King (Acushnet), left, chairman of the Speakers' Committee of the Boston Rubber Group, discusses the technical program with the speakers, S. Everett Perlberg (Adamson United) and Neil L. Catton (DuPont), while James J. Breen (Barrett & Breen), chairman of the Boston Rubber Group, listens.

DuPont Reorganization

► Reorganization of the research and development activities of the Elastomer Chemicals Department, in order to place greater emphasis on pioneering research, has been announced by E. I. du Pont de Nemours and Co., Inc., Wilmington, Del. Dr. John B. Campbell will head a new organization designed to consolidate and extend the long-range activities of the department, as laboratory director of pioneering research. Research work related to the established elastomer chemicals business will be carried out by a unit headed by Dr. Malcolm A. Smook, in the post of laboratory director of supporting research. The two organizations are housed in a recently completed $6 million Elastomer Research Laboratory at the company's Experimental Station.

Dr. Campbell obtained a B.S. degree in chemistry from the University of Kansas in 1947, and in 1949 received a doctorate in organic chemistry from the University of Illinois. He joined DuPont in 1949 as a research chemist at the Jackson Laboratory, Deepwater Point, N. J. In 1956 he was named a division head of the Organic Chemicals Department's laboratory at the Experimental Station. Upon the formation of the Elastomer Chemicals Department, he held the same position in the new department. He had been assistant director of the research laboratories since 1959.

Dr. Smook graduated from the University of California, and received his Ph.D. in organic chemistry from Ohio State University in 1949. He joined DuPont in 1949 as a research chemist for the Ammonia Department at the Experimental Station. In 1953 he was appointed a division head at the Rubber Laboratory at the Chambers Works, Deepwater Point, N. J., and in 1956 he was transferred to the Elastomer Laboratory at the Chestnut Run site. Since 1959 he has been assistant director of the Elastomer Laboratory.

Disogrin Names Appleton

► Bernard S. Appleton, formerly chief engineer and assistant general manager of Greer Marine Corp., has been appointed president and general manager of Disogrin Industries, Inc. He holds engineering degrees from Brooklyn Polytechnic Institute and Yale University and is an Adjunct Assistant Professor at the New York University School of Engineering. Mr. Appleton has served in engineering and managerial capacities in the structural and hydraulic industries. He has been associated with Greer Hydraulics, Inc., and the American Bridge Division of the U. S. Steel Corporation.

General Slates Pilot Plant

► General Tire and Rubber Co., Akron, Ohio, has awarded Crawford and Russell, Stamford, Conn., a contract to design and engineer a pilot plant for both continuous and batch polymerization of isoprene and butadiene to produce stereospecific synthetic rubbers. The pilot plant will be located in Mogadore, Ohio. Two special Crawford and Russell reactors, especially designed for polymerization under very high viscosity conditions, will be used in the new plant.

W. H. MacKay

R. C. V. Mackenzie

E. C. Campbell

Dunlop Vice-Presidents Appointed

► William H. MacKay, R. C. V. Mackenzie, and Edward C. Campbell, the first two in vice-presidential positions, have been promoted at Dunlop Tire and Rubber Corp., Buffalo, N. Y. Mr. MacKay, formerly secretary and vice-president of industrial and public relations, has been elected vice-president in charge of manufacturing; Mr. Mackenzie, formerly vice-president in charge of sales operations, has been elected secretary and vice-president in charge of sales operations; and Edward C. Campbell, formerly manager, tire sales, has been elected assistant vice-president, sales.

Mr. MacKay, a graduate of Dartmouth College, will be responsible for all manufacturing activities, as well as internal and public relations for the company's factories at Buffalo, N. Y., Utica, N. Y., and the Sports Division plant at Westminster, S. C. He has been with the company 32 years and was named vice-president in November of 1957.

Mr. Mackenzie, a graduate of Bishop's College, Quebec, has been with the company since 1938. He has held managerial positions in the Credit and Sales Department, and was named a vice-president in 1954. He now assumes, in addition to his responsibilities as vice-president, the post of corporate secretary.

Mr. Campbell, with Dunlop since 1950, has served as sales manager of the Dunlop Foam Rubber Division, assistant tire sales manager, Easterr regional manager, and New York division manager. He has been sales manager of the Tire Division since October, 1959.

Joint Ubatol Venture

► A joint venture for production and distribution of Ubatol brand polymer emulsions has been announced by the U B S Chemical Co., Cambridge, Mass., and the Permutit Co., Ltd., London, England. The products will be produced at Permutit's chemical works in Ponty Clun, Glamorgan, South Wales, for distribution to the floor polish industry throughout the United Kingdom and the European continent. Permutit will share its manufacturing capabilities with U B S when facilities now being erected begin polymer emulsion production. Previously the Ubatol polymer emulsions for the European market were shipped from the U B S plant in Cambridge, Mass., to distribution points in London and Rotterdam.

Nopco Breaks Ground

► The Nopco Chemical Co., Newark, N.J., recently broke ground in Chattanooga, Tenn., for the construction of a polyether urethane foam plant, designed to allow the company to serve Southern furniture manufacturers more efficiently. The new plant, to cover about 70,000 square feet, and intended to have a capacity of 4 million pounds a year, is expected to be in operation by March 30. The plant will have quality control and research laboratories, and the latest innovations in cutting and fabricating equipment will be included, it is said. The company has also announced that it will build an isocyanate plant in New Jersey, with toluene diisocyanate the major production item. This plant is expected to be in operation by January 1962.

Cabot Names Three

► Cabot Corporation, Boston, Mass., has announced that Dr. Robert W. Cottingham, Robert G. Boucher, and Norbert Olsen, have joined the company's technical staff. Dr. Robert W. Cottingham has joined the Organic and Polymer Research Section of the New Products Research Department as a research chemist. He received his Ph.D. in organic chemistry at the University of Washington in 1956, and was in the Nylon Division of E. I. du Pont de Nemours, Wilmington, Del., prior to joining Cabot.

Mr. Boucher, a graduate of Northeastern University with a B.S. degree in chemistry, came to Cabot as a chemist in the Organic and Research Section of the New Products Department at the Billerica Research Center. Mr. Olsen has joined Cabot as a project engineer in the Process Design and Economic Section of the New Products Research Department. He received his B.S. degree in chemical engineering at Purdue University.

Geauga Plant Addition

► Production is underway at a newly completed $250,000 addition to the Geauga Industries plant at Middlefield, Ohio. The 32,000 square foot addition houses an automated production line for transfer molded parts and links the plant's Banbury mixing section with the main building. It affords straight-through production from the mixer through milling operations, presses and extruders, and secondary finishing operations, to the expanded shipping department. The facility also houses a new laboratory equipped for experimental compounding, pilot runs, and testing. The extrusion department and offices have been expanded.

Cellusuede Floral Flock

► Aqua-Spray Rayon Floral Flock is described by its manufacturer, Cellusuede Products, Inc., Rockford, Ill., as a floral flock with its own built-in adhesive material, which requires only water for application. It is designed for use in flocking holiday trees and wreaths as well as other floral pieces and decorations. It is flame-proof and need only be sprayed on. According to the company it flows freely and will not stick or clog in flocking equipment. The product is available in three colors, White Sno, Pale Pink, and Icy Blue.

Southern Rubber Group Holds Panels on Tires and SBR

► Panel symposiums on "Tires" and "SBR Production" were held at the Fall Meeting of the Southern Rubber Group, held on October 7 and 8, 1960, at the Roosevelt Hotel in New Orleans, La. Over 275 members and guests, plus 90 women, attended the two-day meeting. At a banquet held on October 7, Dr. J. P. McKenzie (Copolymer Rubber & Chemical) presented the Southern Rubber Group's Harmon Connell Scholarship Award to its fourth recipient, Hugh O. Holland, a senior at Mississippi State University.

The panel discussion on "Tires," moderated by R. R. Adams (Goodyear), was held on the afternoon of October 7. The three talks presented at this session were: "Engineering Aspects of Pneumatic Tires for Ground and Air Vehicles," by James L. Killian (Goodrich International); "Some Concepts of Tire Compounding," by Irvin J. Sjothun (Firestone), presented by K. W. Brandau (Firestone); and "Tire Manufacturing," by R. H. Williams (Armstrong Tire).

Three speakers made up the panel on "SBR Production," held on October 8 and moderated by M. D. Lange (Columbian Carbon). The subjects discussed and the speakers were: "The Basics of SBR Productions," by J. D. Sutherland (Copolymer Rubber & Chemical); "Packaging of SBR," by Paul C. Baker (Goodrich-Gulf); and "Quality Control of SBR Rubber," by E. T. Panowich (General Tire). Abstracts of the six papers presented follow:

Panel on Tires

Engineering Aspects of Pneumatic Tires for Ground and Air Vehicles, by James L. Killian (Goodrich International). Practically all ground and air vehicles are dependent on the pneumatic tire for efficient mobility. There is no substitute that can provide riding comfort, low rolling resistance, low contact pressures, directional control, traction, and durability at comparable unit cost and weight. The pneumatic tire is essentially a complete suspension system within itself. It performs, in some measure, the same function as a combination of springs, torsion bars, shock absorbers, sway bars, and, in addition, provides the surface contact. The phenomenal growth in performance and diversification of ground and air vehicles in the past two decades has placed unusual pressure on tire engineers to keep pace. While the pneumatic tire may appear to be a rather commonplace article, it is the intent of this paper to point out the engineering challenge presented by this amazing structure.

Some Concepts of Tire Compounding, by Irvin J. Sjothun (Firestone). Tire compounding is the science of designing stocks or compounds to obtain (1) desired quality or ultimate properties of the finished product, (2) acceptable processing characteristics commensurate with the equipment on which the compounds are to be processed, and (3) a cost level which will permit its acceptability. Compounding, therefore, deals with rubbers and compounding materials, their ratios, mixing techniques, processing, curing, and costs. Since the basic compounding material descriptions and formulations are readily available in trade journals, suppliers' releases, and a number of books, this paper will treat only certain concepts or problems with respect to the several types of tires which are considered of general or unusual interest to research groups, suppliers, and tire development people. Furthermore, this paper will concern itself mainly with the quality aspect.

Tire Manufacturing, by R. H. Williams (Armstrong Tire). Production's responsibility in tire manufacturing involves the utilizations of the specifications issued by both laboratory and tire design to produce the components and the finished tire with the least variations from specification to produce a quality product at the lowest cost. This paper discusses the typical operations involved to produce a tire. These are: mill room; calendering of fabric; manufacture of components; bead making; tire building; tire curing; final finish; and warehousing and shipping. Research and development activities are also covered.

Panel on SBR Production

The Basics of SBR Production, by J. D. Sutherland (Copolymer Rubber & Chemical). Butadiene-styrene rubber (SBR) is the elastomeric product of the copolymerization of butadiene and styrene in an emulsion system formerly known as GR-S (Government Rubber-Styrene). Because of its ability to be substituted for, and used in combination with, natural rubber, SBR has earned for itself the common name of synthetic rubber although it is not of the same composition as natural rubber. This paper covers the historical background of rubber; the Government rubber program; the manufacture of butadiene monomer; the manufacture of styrene monomer; other chemicals used in the manufacture of SBR; and the manufacture of SBR.

Speakers on the "SBR Production" panel, held by the Southern Rubber Group on October 8. Left to right: moderator, M. D. Lange (Columbian Carbon); J. D. Sutherland (Copolymer Rubber & Chemical); E. T. Panowich (General Tire); and P. C. Baker (Goodrich-Gulf).

Speakers on the "Tires" panel, held by the Southern Rubber Group on October 7. Left to right: K. W. Brandau (Firestone); moderator, R. R. Adams (Goodyear); J. L. Killian (Goodrich International); and R. H. Williams (Armstrong Tire).

Packaging of SBR, by Paul C. Baker (Goodrich-Gulf). Those engaged in the manufacture of SBR have a tremendous problem in packaging. From the beginning of the SBR program, this problem was packaging a liquid as though it were a solid. SBR is a liquid. It has no rigidity —only resistance to flow. In addition to its fluid properties, rubber has a decided tendency to adhere to almost any container. Some of this characteristic of adhesion to the container is due to an intrinsic property of adhesion which is found in the rubber itself. Some of it is due to the fluid characteristics of the rubber, which cause it to flow into the spaces between the fibers which make up the cardboard, or into gross openings which are left when the package is assembled. These characteristics are further complicated by the fact that rubber is a material which must be handled in large volume, and under a wide variety of conditions. Also, rubber must be packaged to meet the needs of customers. This paper discusses how the packaging problems are handled.

Quality Control of SBR Rubber, by E. T. Panowich (General Tire). Following the inception of the synthetic rubber program under governmental operation in 1941, the agencies were charged with the responsibility of defining and maintaining quality standards for the polymers produced. The more obvious SBR properties affecting customer acceptance of a product are those which are visably detected, such as moisture, contamination, packaging, processing, and to a lesser extent, cure characteristics. The paper outlines additional efforts made to control the more subtle properties of SBR which may not be detected by visual or analytical techniques. For the purpose of this presentation, the scope of a quality control program will include 42°F. SBR copolymers of the following types: (1) unpigmented; (2) oil extended; and (3) black masterbatches with and without oil extension, the paper states.

Firestone Names Bowers

► Paul D. Bowers has been promoted to the newly created post of chief chemist for all North American tire plants of the Firestone Tire and Rubber Co., Akron, Ohio, and will head all tire plant laboratories in the company's tire plants in the United States and Canada. Mr. Bowers holds a B.S. degree in chemistry from Mount Union College, Alliance, Ohio. He started with Firestone in 1928 in the general laboratory, and in 1937 was named chief chemist at the company's plant in Memphis, Tenn. He returned to Akron in 1951 as manager of the Service Compounding Division and was named manager of product engineering in the company's Development Department in 1957. He is a member of the American Chemical Society, the Rubber Division of A.C.S. and the Akron Rubber Group.

R. Henry Davis

Appointed by Cooper

► R. Henry Davis, formerly sales manager of the division, has been promoted to the post of general manager of the Industrial Rubber Products Division of the Cooper Tire and Rubber Co., Findlay, Ohio. In his new capacity he will be in charge of all operations of the division at both the Findlay and Auburn, Ind., facilities. Mr. Davis received a B.S. degree at Denison University and is also a graduate of the American School of Management. He joined Cooper in 1939 as assistant purchasing agent and was later promoted to the post of purchasing agent. He became associated with the Industrial Rubber Products Division as sales manager in 1946 when the division was newly formed.

N-E Elects 1961 Officers

► The Elastomer and Plastics Group, Northeastern Section, ACS, elected its 1961 officers at its annual meeting on October 18, 1960. Dr. Robert D. Stiehler (National Bureau of Standards) was the featured speaker at the meeting, and the subject of his talk was "The Activities of the National Bureau of Standards with Special Reference to the Testing of Rubber."

The officers elected to serve the group in 1961 are: *Chairman*, Henry A. Hill (National Polychemicals); *Chairman-Elect:* Joseph M. Donahue (Goodyear); *Secretary*, Henry S. Anthony (Tyer Rubber); *Treasurer*, Elmer E. Ross (T. C. Ashley); *Custodian*, Frank Gantry (Terrell Corp.); *Chairman, Hospitality Committee*, Warren Waite (Craig Systems); *Executive Committee Member*, C. Mijol (U B S Chemical).

Argentina Facility Slated

► Plans for the manufacture of rubber chemicals including accelerators and antioxidants in Argentina have been announced by B. F. Goodrich Chemical Co., Cleveland, Ohio, and R. T. Vanderbilt Co., Inc., New York, N. Y. The two firms have been associated for many years in the distribution of these chemicals. In this new venture they will be associated with Atanor S.A.M., one of Argentina's largest chemical firms.

It is planned that production facilities will be located in the vicinity of Buenos Aires. These facilities will be capable of handling current Argentine requirements for rubber chemicals plus the country's projected needs, including the requirements of a new synthetic rubber plant planned for the country. In order to meet Argentina's rubber chemical requirements during plant construction, arrangements will be made for interim production in existing Atanor facilities.

These chemicals build in desirable properties of wear and long life, prevent deterioration and perform a host of other vital jobs. They also find use in the petroleum, plastics and other industries. The Argentine project is the second South American venture announced this year by Goodrich Chemical. In July the firm announced its intention to construct a plant in Colombia for the manufacture of Geon vinyl plastic materials in cooperation with Colombian investors.

Seiberling Breaks Ground

► Ground has been broken for a $1.5 million rubber goods plant in Batesville, Ark., by the Seiberling Rubber Co. The unit will be known as the Batesville Rubber Co. and operated as a subsidiary for the production of heels and soles for shoes, and tire retreading material for the expanding Southern and Western markets. Construction of the 100,000 square foot plant is expected to be completed some time next summer. T. K. Sieberling, manager of Sieberling's Shoe Products Division, will be president of the new company. The start of the project marks the third major step in Seiberling's expansion in a little over a year. In 1959 the firm's Plastics Division plant in Newcomerstown, Ohio, was doubled in size, and at the beginning of this year it was announced that close to $2 million would be spent in 1960 to improve tire production facilities at the Barberton, Ohio, headquarters.

Talks On Adhesives Heard by PRG

► Adhesives and adhesion was the subject of two talks presented at the October 7, 1960, meeting of the Philadelphia Rubber Group, held at the Poor Richard Club in Philadelphia, Penna. The first speaker, William M. DeCrease (Hughson Chemical) spoke on "Rubber-to-Metal Bonding, 1955-1960," and the second speaker, Dr. Matthew W. Wilson (Goodrich), discussed "Tire Fabric Adhesion."

Mr. DeCrease stated that in early 1955 brass plating accounted for about 20 per cent of the rubber-to-metal bonded parts being made in industry, with 60 per cent being made up of two-coat adhesive systems and only 20 per cent using a one-coat organic adhesive. According to the speaker, in 1960 brass plating accounts for 15 per cent, and the remaining 85 per cent of bonded parts is made with organic adhesives—55 per cent using a one-coat adhesive and 30 per cent using a two-coat system. The speaker pointed out that this increase in the use of one-coat adhesives is indicative of the dependability of present day rubber-to-metal adhesives.

In his discussion on compounding, Mr. DeCrease gave a review of his paper "Compounding Elastomers for Rubber-to-Metal Adhesions," which appeared in the September, 1960 issue of RUBBER AGE.

Mr. DeCrease concluded his talk with a look into the next five years in an attempt to predict important developments in rubber - to - metal bonding. His predictions were: the service requirements for rubber-to-metal adhesives will be elevated, with particular regards to resistance to high temperatures, corrosive environments, and organic liquids; the range of cure temperatures for processing bonded units will very likely be expanded; bonding castable elastomers, room temperature curing elastomers, and vulcanized elastomers to metal will present new challenges; and brass plating will essentially disappear from the rubber-to-metal bonding scene and be replaced with organic adhesives.

The second speaker, Dr. Wilson, explained that the story of tire fabric adhesion in the last 20 years has been, to all intents and purposes, the story of resorcinol - formaldehyde-latex (RFL). He pointed out that a certain amount of substitution or modification is possible, but for the most part the RFL system is a very specific one. Dr. Wilson stated that one cannot just substitute for the resorcinol - formaldehyde resin any resin, such as urea-formaldehyde, melamine - formaldehyde, or even phenol-formaldehyde.

Dr. Wilson went on to describe the reasons for the adhesion produced by RFL, covering the mechanism and theory of RFL adhesion and the testing and practical factors of the system.

J. E. Hargreaves

Heads Scott Southern

► John E. Hargreaves, formerly manager, has been appointed president of Scott Testers (Southern), Inc., and will have his offices in Spartanburg, S. C. He succeeds James M. Scott who died in June. Mr. Hargreaves' education included special studies in textiles at both the Rhode Island School of Design and the Massachusetts Institute of Technology. He served as a laboratory technician for J. and P. Coats, Pawtucket, R. I. and Jones, Gardner and Beal, Inc., Providence, R. I., joining Scott Testers, Inc. in 1952. In 1953 he was placed in charge of service and repair operations at Spartanburg, and in 1958 he assumed the responsibility for sales as well. As president he will continue to supervise sales and service of Scott testing equipment for the textile, rubber, paper, leather, plastics, and wire industries throughout the Southeastern United States.

PRG Scholarship Awarded

The Philadelphia Rubber Group has announced that Robert J. Samuels has been awarded its scholarship by the Akron University Scholarship Committee. Mr. Samuels is a graduate of Stevens Institute of Technology, where he earned his M.S. degree in 1955.

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The new Scott Specimen Dimension Compensator automatically adjusts test recordings for dimensional changes in specimen thickness, width, diameter, or cross-section. The operator merely sets the 20-step dial control to the measured variable of the specimen before making the test — the Scott compensator unit does the rest! On special order the number and magnitude of steps may be tailored to suit the job requirements.

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SCOTT TESTERS

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E. R. Bridgwater

Retires from DuPont

► Ernest R. Bridgwater, assistant general manager of the Elastomer Chemicals Department of E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., will retire on January 1 after 37 years with the company during which he played a key role in commercializing neoprene. Mr. Bridgwater studied at the University of Akron and received a B.S. degree from the Massachusetts Institute of Technology in 1918. He was employed by the B. F. Goodrich Co. for three years, and by the Firestone Tire and Rubber Co. for two years before joining Du Pont.

In 1924 he joined Du Pont as a rubber chemist, and in 1929 he became sales manager of the Rubber Chemicals Division. He was appointed division manager two years later. In 1949, following the consolidation of division manufacturing activities into a separate manufacturing division for the Organic Chemicals Department, he was named director of sales for the Rubber Chemicals Division. In 1957 he became assistant general manager of the newly created Elastomer Chemicals Department.

Riegel Separating Paper

► Riegel Paper Corp., New York, N. Y., has announced a new interleaving and separating paper called Strip-Ease. It is a silicone coated kraft that the company claims will not stick to tacky rubber, pitch, asphalt, plastic compounds, and similar materials, and it is said to be durable enough to permit multiple reuse in many rubber processing applications.

R/A Advertiser Wins AAAN Award

► An advertisement by the Sid Richardson Carbon Co. of Fort Worth, Texas, in the September, 1960 issue of RUBBER AGE, received an International Award from the Affiliated Advertising Agencies Network in its 1960 competition. The award came in competition with more than 800 entries sent to the October 11-15 AAAN convention in Phoenix, Arizona, by the organization's 48 U.S. and 11 foreign affiliated agencies. Thomas L. Yates Advertising Agency of Fort Worth produced the Sid Richardson advertisement. A certificate marking the award was presented to Frank L. Andrews, vice-president and general manager of Sid Richardson Carbon by agency president Thomas L. Yates. Dual purpose of the award-winning advertisement, Mr. Andrews said, was to acquaint the carbon black industry with his company's intention to enter the furnace black field upon the completion of a new plant in Big Spring, Texas, and to let it be known that the firm would remain in the channel black business. Mr. Andrews stated that the ad is the first in a series being published during the year the new furnace black plant is being built.

Firestone Plant Manager

► E. H. Strobel has been appointed factory manager of plant 1 of the Firestone Tire and Rubber Co., Akron, Ohio, succeeding H. W. Boettner who has retired after 40 years with the company. Mr. Strobel graduated from Ohio State University with a B.S. degree in engineering. He received an M.S. in rubber chemistry from the University of Akron. He joined Firestone in 1941, leaving a few months after for military service with the Army Ordnance Department. Following his discharge in 1946 he returned to Akron and served in the plant 1 production division. In 1948 he was transferred to the company's Buenos Aires, Argentina, plant where he became production manager a year later. He was appointed plant manager in 1951. In 1954 he went to Firestone's Des Moines, Iowa, plant as production manager and he was named plant manager there in 1958. He was transferred to Akron this year as a member of the staff of H. H. Wiedenmann, vice-president, tire production.

G. Stephen Glaser

Named by G-E Silicone

► G. Stephen Glaser has been appointed sales representative of the Eastern District of the Silicone Products Department of the General Electric Co., and will have his offices in Newark, N. J. A graduate of Princeton and Northwestern Universities, Mr. Glaser holds a B.S. degree in mechanical engineering and a masters in business administration. Following his graduation from Princeton in 1955, he joined E. I. du Pont de Nemours and Co., Inc., Wilmington, Del., where he served as a project engineer until 1957. In 1958 he became associated with General Electric, in the company's marketing training program. His first assignment was at the company's Semiconductor Department in Syracuse. He subsequently served at General Electric plants in Cincinnati, Phoenix, Detroit and Louisville, and he joined the marketing section of the Silicone Products Department in January.

McCarthy Promoted

► Edward W. McCarthy, with the company as chief chemical engineer since 1952, has been appointed a vice-president of Chemical Rubber Products, Inc., Beacon, N. Y. He will continue his activities as director of research and development of coated fabrics. Mr. McCarthy holds a degree in chemical engineering from the Polytechnic Institute of Brooklyn. He had been active in the rubber industry for 13 years before joining Chemical Rubber, and is a member of the Rubber Division of the American Chemical Society, and the American Institute of Chemical Engineers.

W. J. Hegedus

In Field Sales Post

► Walter J. Hegedus has been appointed field sales engineer in the Pittsburgh, Penna., area for Farrel-Birmingham Co., Inc., Ansonia, Conn., succeeding David Neill, who has been transferred to the company's home office as manager of roll grinding sales. Mr. Hegedus holds a degree in mechanical engineering from Fenn College, Cleveland, Ohio, and has been in industrial sales work for the past ten years. He will continue to be located in the company's Akron office.

Win Dinsmore Awards

► Three tire development employees of Goodyear Tire & Rubber Co., Akron, Ohio, have been presented the R. P. Dinsmore Awards of Merit for 1960; Eugene E. McMannis, Charles N. Meier, and Walter C. Croysdale. Mr. McMannis, chief engineer of tire design research, was recognized for his work in developing a new design in ultra high speed tires. Mr. Meier, a compounder, was cited for his work in developing improved tread splice cements, and Mr. Croysdale, for his contributions to the production of precision tires.

Mansfield Buys Pacific

► Mansfield Tire and Rubber Co., Mansfield, Ohio, has announced that it has completed negotiations for the purchase of Pacific Tire and Rubber Co., Oakland, Calif., for an undisclosed price. Inland Rubber Corp., a wholly-owned subsidiary of Mansfield, has owned 50 per cent of Pacific's stock since 1951, and the remainder of the stock was acquired from Bay. Mansfield has operated the Oakland plant's tire and tread rubber manufacturing facilities through lease agreements since 1952.

Dow Polyethylene Plant

► Facilities for the production of polyethylene foam will be constructed at the Hanging Rock Plant of the Dow Chemical Co., at Ironton, Ohio, and are expected to be completed in June, 1961. The plant structure will cover 61,000 square feet, and the installation will provide employment for 30 to 40 people. The plant will produce Ethafoam, the trademark for Dow polyethylene foam. R. P. Lowry of Dow's Engineering Department in Midland is project engineer for the plant.

Shell to Acquire Site

► Shell Chemical Co., New York, N. Y., has announced plans to acquire a site near Marietta, Ohio, for a multimillion dollar polyisoprene plant, in line with the company's plan to expand its polyisoprene production facilities to a capacity of 120 million pounds a year. The new Ohio plant will have a capacity of 80 million pounds a year and will employ about 250 people. It is expected to go on stream late in 1961 and its output will go into a variety of end products.

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Names in the News

Lee L. Blyler has been elected president of Howe & French Inc., Boston, Mass., succeeding **C. Walker TenBroeck** who has been named chairman of the board.

Dr. Frank Campins, president of Polymer Industries, Inc., Springdale, Conn., spoke at the closing meeting of the 22nd Annual National Packaging Forum held at the Statler-Hilton in New York City.

H. E. Kaufman has resigned his post of vice-president and director of Vanderbilt Tire and Rubber Corp. to become president of Newport Automotive Stores Corp., New York, N. Y.

Anselm DeGhetto, formerly vice-president and manager of the Clifton Division of National Rubber Machinery Co., has joined Getty Machine and Mold, Inc., Clifton, N. J., as president.

Dr. Waldo L. Semon, director of rubber research for B. F. Goodrich Co., Akron, Ohio, received the Distinguished Award of Council from the Akron Council of Engineering and Scientific Societies.

Harold G. Osborn, a senior vice-president of Continental Oil Co., has been elected chairman of the board of Continental Carbon Co., Houston, Texas.

R. C. Schmidt has been appointed director of purchasing and traffic for the Cooper Tire and Rubber Co., Findlay, Ohio, replacing **D. J. Stein** who has been forced by a recent illness to limit his activities and will continue with Cooper as assistant purchasing agent.

Albert R. Blanchard, formerly manager of credits with the B. F. Goodrich Footwear and Flooring Co. has been appointed assistant treasurer of the B. F. Goodrich Co., Akron, Ohio.

Henry L. Schulle has joined Stauffer Chemical Co. as a sales representative of the Industrial Chemicals Division and will have his headquarters in the company's Houston, Texas, office.

Clyde D. Segner has been named technical service manager for the International Sales Department of B. F. Goodrich Chemical Co., Cleveland, Ohio, succeeding **Paul E. Ditto,** who has been named technical service manager of B. F. Goodrich-C.S.R. Chemicals Pty. Ltd., Australia.

Arthur V. Krone has been appointed general traffic manager of the United Carbon Co., Inc., Charleston, West Va., with responsibility for coordinating all phases of the transportation and freight traffic management functions and activities.

Professor Peter J. W. Debye of Cornell University has been chosen the 1961 Nichols Medalist by the New York Section's Jury of Award.

Ralph Wechsler, chairman of the board of Nopco Chemical Co., Newark, N. J., was honored recently at a testimonial dinner marking his retirement from the company after almost 40 years of service.

Philip T. Rogers has been appointed vice-president and general manager of the ARco-Wynn Valve Division of the Automotive Rubber Co. of Detroit, Mich., and will have the responsibility of directing the division's expansion in the valve industry.

Thomas A. Marshall, Jr., senior assistant secretary of the American Society of Mechanical Engineers, has been elected executive secretary of the American Society for Testing Materials.

Mark W. Laibe, vice-president of the Goodyear Tire and Rubber Co., Akron, Ohio, was presented with a gold tie-clasp on the occasion of his 35th anniversary with the company.

George B. Longan, formerly division sales manager for the Middle and Far East, has been named managing director of the Firestone Tire and Rubber Co. plant in Buenos Aires, Argentina.

R. A. Baker, manager of the Machinery Division of Cabot Corporation, Boston, Mass., has been elected vice-president of the corporation.

R. L. Daileader

Named by G-E Silicone

► Robert L. Daileader, who joined the Silicone Products Department of the General Electric Co., last year as a technical service specialist in the Rubber Market Section, has been named a sales representative for the department. He will be located in Bridgeport, Conn. He holds a B.S. in chemical engineering from the Polytechnic Institute of Brooklyn, and a Master's degree in chemical engineering from Northwestern University. Before joining General Electric he was a process engineer with Esso Research and Engineering for eight years.

Dr. Robert D. Beattie has been appointed to the newly created position of polyolefins project manager for the New Products Research Department of Cabot Corporation, Boston, Mass.

Paul Terreta, president of O'Sullivan Rubber Corporation, Winchester, Va., has been named a director of the Virginia Manufacturers Association, effective January 1.

Dr. Carl A. Gerstacker has been named to succeed **Dr. Earl Bennett** as chairman of the board of directors, upon Dr. Bennett's resignation, and **Herbert D. Doan** has been named executive vice-president, of Dow Chemical Co., Midland, Mich.

Alden H. Davis and **Charles R. McGill** have joined the sales service group of J. M. Huber Corp. and will be associated with the Development Department located in Borger, Texas.

Arthur E. Bailey

Appointed by Copolymer

► Arthur E. Bailey has been appointed sales representative of the Northeastern and Mid-Atlantic areas for Copolymer Rubber and Chemical Corp., Baton Rouge, La. Mr. Bailey has been with Copolymer since 1957 and has served in various capacities with both the Rubber Reserve Co. and its successor, the Federal Facilities Corp. He will maintain his headquarters in Hartford, Conn. The states which have been added to the area he already services are New Jersey, eastern Pennsylvania, Delaware, Maryland and eastern West Virginia.

Named by Goodrich

► P. W. Perdriau, general manager of the Aviation Products Division of B. F. Goodrich Co., Akron, Ohio, since 1956, has been named president of the company's Industrial Products Co. Mr. Perdriau graduated from Harvard University with a B.S. in engineering and industrial chemistry, joining Goodrich upon graduation. During World War II he was production manager of fuel cell manufacturing in the Aeronautical Division in Akron, and later, manager of fuel cell and de-icer manufacturing at the Los Angeles, Calif., plant. In 1945 Mr. Perdriau was named manager of the company's tire manufacturing plant in Los Angeles. Two years later he returned to Akron as superintendent of the Tire Division. He became director of employee relations for the tire company in 1954, a position he held when named to head the Aviation Products Division. He is also chairman of the board of Goodrich-High Voltage Astronautics, Inc., an associate company.

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Financial News

General Tire

► Nine months ended August 31: Profits amounted to $16,272,431, equal to $2.90 a common share, compared with $20,320,567, or $3.79 a share, for the same period of last year, representing a 20 per cent decline in earnings. Sales were up by 11 per cent to a record high of $535,428,022, from the $483,644,239 volume of the same fiscal period of 1959. Earnings for the quarter were $5,035,467, against $6,390,758; and sales were $184,675,125, against $178,304,965 last year. In commenting on the report to stockholders, M. G. O'Neil, company president said: "Despite some recent favorable cost developments in crude rubber, our over-all earnings reflect the inflated rubber costs which have been prevalent since the beginning of this fiscal year. He also stressed increased labor costs, "the industry's eroding price structure in the replacement tire market," and non-recurring start-up charges for the company's new plant in Mayfield, Ky.

U.S. Rubber Reclaiming

► Nine months ended Sept. 30: Net income was $387,182, or 87c a share, compared with $417,096, or 93c a share, for the same period last year. Sales amounted to $5,511,138, compared with $5,386,374 last year. Third quarter net income was $88,928, or 20c a share, compared with 123,006, or 28c a share, in 1959. Sales were $1,564,118 compared with $1,665,029 last year.

Anderson-Prichard

► Nine months ended Sept. 30: Net income reported was $3,863,364, equal to $2.03 per share, compared to $4,866,719, or $2.75 per share, for the like period of 1959. Revenue rose to $55,870,422, from $54,508,847 for the comparable period last year.

Anaconda Wire

► Nine months ended September 30: Net income after taxes fell to $556,000, or 66c per share of common stock, from $2,759,205, or $3.27 for the like period of 1959.

Monsanto Chemical

► Nine months ended September 30: Net income declined to $46,475,000, or $2.01 a share, from $50,412,000, or $2.18 a share in 1959. Sales, however, rose to $636,564,000 from $613,188,000 last year. Irving C. Smith, company vice-president, said that the third period was traditionally the company's poorest. "If the normal pattern follows, we should do better in sales and earnings for the fourth quarter than we did in the third." Earnings for the third quarter were down to $12,989,000, or 56c a share, from $15,203,000, or 66c a share last year, while sales increased slightly to $204,777,000 from $199,480,000 in the like 1959 quarter. Mr. Smith said that the profit decline in the third quarter was the result of lower selling prices and higher costs. He stressed price drops in polyethylene, polystyrene, polyvinyl chloride and acrilonitrile.

Thiokol Chemical

► Nine months ended Sept. 30: Net income dropped 34 per cent for the period, to $2,663,006 from $4,060,355 for the comparable period of 1959, representing a decline per share to 58c from 90c. Sales of $124,429,898, compared to sales of $127,883,796 for the period last year. The company points out that certain non-fee bearing contract overrun costs occurred in rocket operations, and that the problems causing the added costs are subsiding. The company considers the fact that the sales level remained about the same "a favorable comparison in the light of the general downturn of industrial activity currently being experienced," while pointing out that reduced sales to its Rocket Divisions were reflected in a decrease of 21 per cent in total sales from chemical operations.

Plymouth Rubber

► 26 weeks ended May 28: Net income amounted to $571,470, equal to 70c per share, contrasted to $550,288, or 62c a share for the like period a year ago. Net sales were down to $11,563,872, from $11,901,105 for the like period of 1959.

Goodrich

► Nine months ended September 30: The company reported a decline in earnings, to $24,121,747, or $2.68 a share, from $28,820,709, or $3.20 a share, in the like period of 1959. Sales for the period were $587,602,200, compared to $578,478,605 in the same period of last year, for a 1.6 per cent increase. Earnings last year were affected by a non-recurring profit of $2,231,083, or 25c a share, resulting from the sale of Harmon Color Works to Allied Chemical Corp., but were also offset by a 55-day strike. Included in net income are unconsolidated subsidiary and associate company dividends received by Goodrich. Increases in equity in net income of these subsidiaries, however, are not. Equity increases amounted to $1,350,000 for the period, compared with $1,600,000 a year earlier, after adjustments for currency devaluations.

Reeves Brothers

► Year ended July 2: Net earnings for the 53 week year were $2,262,016, or $1.94, compared to $974,843, or 85c for the 1959 52 week fiscal year ended June 27 of last year. Sales climbed to $71,718,458, from $62,042,518. According to John M. Reeves, chairman of the board, "The improvement can be attributed to the healthier market conditions in the textile industry during the year under review, as well as to the progress made by Reeves Brothers in improving its textile and industrial operations, plus the company's continuing diversification program."

Goodall Rubber

► Six months ended June 30: Net income dropped to $162,609, or 34c a share, from the $238,390, or 50c per share, reported for the first half of 1959. Sales rose to $7,373,541, a new record for the company, from $6,591,607 for the like period a year ago.

Carlisle Corp.

► Six months ended June 30: Net income was $668,673, equal to 56c per share, down slightly from the $673,691, or 61c per share, reported for the comparable period last year. Sales rose to $12,455,815, compared to the $11,267,763 sales reported for the same period in 1959.

Ross A. Corio

In New Post at Grace

► Ross A. Corio has been appointed to the newly created position of vice-president in charge of marketing and sales of the Hatco Chemical Division of W. R. Grace and Co., New York, N. Y. In his new post Mr. Corio will be in charge of the development of new product lines and will be responsible for all division sales operations.

He holds a Bachelor of Chemical Engineering degree from Cooper Union, and before joining Grace was associated with the Union Carbide Chemicals Co., New York, N. Y. He was assistant district manager in Carbide's Newark office, and was named manager of the Newark, N. J., district sales office in 1956.

Goodrich Offers License

► The B. F. Goodrich Co., Akron, Ohio, has announced that a license to produce Ameripol-SN, described as the exact synthetic duplicate of tree rubber, is available to manufacturers in the United States and Canada through Goodrich - Gulf Chemicals, Inc. According to the company, the new rubber was tested on highways some years back and gave mileage and service "greatly superior" to tires in which other man-made rubbers were used, comparing favorably with similar tires made of tree-grown rubber. Pilot plant production of the new synthetic, said to duplicate tree-grown rubber's molecular structure, began in 1956. Goodrich is offering a license on the process following a consent decree issued by the U. S. District Court for the District of Columbia terminating a legal action filed in 1957 by the Government against Goodrich.

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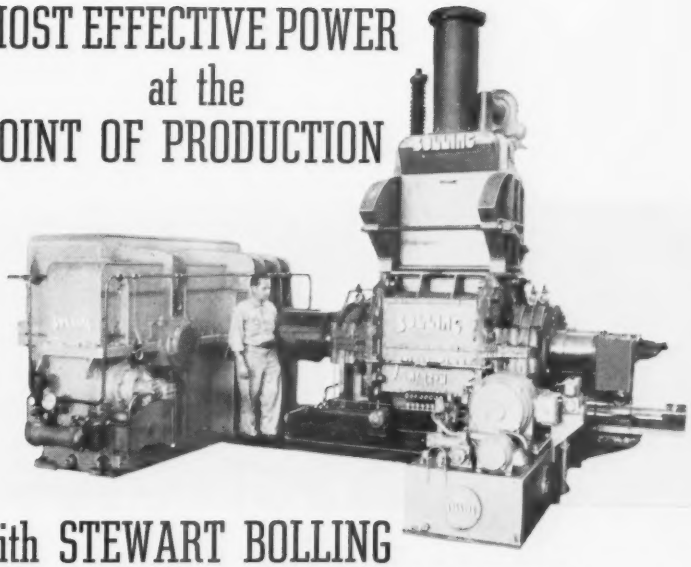

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West Coast News

► The October 4th meeting of the Los Angeles Rubber Group, held at the Biltmore Hotel in Los Angeles, Calif., featured an address by E. R. Bartholomew of the Wright Air Development Division. Mr. Bartholomew spoke on "Air Force Research on Nonmetallic Materials." The speaker pointed out that throughout the history of air weapons, nonmetallic materials such as elastomers, plastics, adhesives, coatings, fibers and others have been indispensable to the successful performance and reliability of such weapons. The continued importance of these materials to advanced aerospace vehicles was discussed, and typical current Air Force research programs directed toward advancing the State-of-the-Art in the materials area was reviewed.

Emphasis was placed on the need for improving the environmental stability of all nonmetallic materials essential to flight vehicles and their related systems. Such improvements must include serviceability over the range of below —400°F. to many thousands of degrees Fahrenheit, combined with resistance to radiations, high vacuum and many other adverse environments.

The non-technical portion of the meeting was addressed by Dr. James D. Calderwood, international economist, who spoke on "Troubled Neighbors: South America in Transition." The meeting was arranged by the Culver City Group, a group of companies from the Culver City area including Advance Latex, Parker Seal, Stillman Rubber and Western Backing.

► Casper P. Scalia has been appointed western regional representative for tread rubber and repair materials, U. S. Tires Division, U. S. Rubber Co. Mr. Scalia, formerly manager of western tread rubber sales for Mohawk Rubber Co., will make his headquarters in the Los Angeles tire plant of U. S. Rubber.

► Fife Manufacturing Co., Inc., Oklahoma City, Okla., manufacturer of a complete line of automatic web guiding and edge aligning equipment, has relocated its West Coast offices from Hayward, Calif., to Downey, Calif.

► The monthly meeting of Tlargi was held on November 1 at the Biltmore Hotel, Los Angeles, Calif., and was attended by 238 members and guests. William Deis (Merck Marine Magnesium) was the featured speaker at the technical meeting, giving an address on "Magnesium Oxides in Elastomers." Mr. Deis stated that two general types of magnesium oxide are available to the rubber compounder, and the two types differ in their purity and surface activity or rate of reaction with acid. He explained that the heavy calcined magnesium oxide designation refers to highly calcined, inactive type which finds rather limited use in current compounding. However, he pointed out, the active types are a necessary and important compounding ingredient for many elastomers.

Mr. Deis informed the group that the magnesium oxide properties which are of most importance to the rubber compounder are: ignition loss; impurities; particle size; and surface activity as defined by iodine adsorption. According to the speaker, generally the relation of surface activity of magnesium oxide to best over-all performance in various elastomers is: Neoprene, chlorobutyl, and SBR — high surface activity; fluoroelastomers — intermediate to low surface activity; Hypalon—low activity for optimum scorch protection; butyl — low activity for best ultra-violet reflection.

► Wharton Jackson Co., San Marino, Calif., has joined with Harrisons & Crosfield (America) Inc., to form Harrisons & Crosfield (Pacific) Inc., with offices in San Marino, San Francisco, and Seattle, Wash. Wharton Jackson and R. J. Davidson will serve as vice-presidents and directors of the new company. The company will carry on the business formerly operated by both firms on the Pacific Coast in minerals, pigments, extenders, chemicals, lumber, and other industrial raw materials.

► American Mineral Spirits Co., Chicago, Ill., has appointed Robert G. Snowden manager of special products for its Southern California Division. Mr. Snowden will be responsible for the South California distribution of related chemical.

► Appointments to the board of management of the Burke Rubber Co., Inc., San Jose, Calif., have been announced by the Executive Committee. Members are Al DeMell, John Byrne, Walt Pratt, John Campbell, Wally Jensen, Ray Brown, Bill Davidson, Roger Theiss, John Montgomery and Harry Sullivan. Ray Brown has been appointed chief chemist, with full responsibility for all laboratory operations including formula development, research and development, factory compounding, and services. The new board, which operates the company's sales development and growth, will be directly responsible to the Executive Committee composed of the following corporate officers: *Board Chairman*, Roscoe Burke; *President*, Halsey Burke; *Senior Vice-President*, Norman Burke; *Vice-President and Technical Director*, D. W. Kutnewsky; *Secretary-Treasurer*, Virgil Price; and *Assistant Secretary - Treasurer*, Gregor MacGregor.

► Continental Carbon Company has awarded the construction and engineering contract for a Bakersfield, Calif., carbon black plant to the Ralph M. Parsons Co. of Los Angeles, Calif. Construction will start immediately, and completion of the $4 million plant is anticipated in early summer 1961. Carbon black capacity is expected to be 50 million pounds a year.

The Bakersfield plant will be the first carbon black plant on the West Coast. It will enable Continental Carbon to broaden its services to the growing West Coast carbon black market. The plant's carbon black products will be distributed by Witco Chemical Co., Inc., exclusive worldwide distributor of Continental Carbon's products.

► Mansfield Tire & Rubber Co., Mansfield, Ohio, has completed negotiations for the purchase of Pacific Tire & Rubber Co., Oakland, Calif. James H. Hoffman, president of Mansfield, states that Inland Rubber Corp., a wholly-owned Mansfield, subsidiary, has owned 50 per cent of Pacific Tire stock since January, 1951, and the remaining 50 per cent now has been acquired from Bay Rubber Co. The purchase price was not disclosed. Through a lease agreement, the Mansfield company has operated the Oakland plant's tire and tread rubber manufacturing facilities since November 1, 1952.

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It's a long way from Chicopee Falls, Massachusetts, to Singapore and back, but Copolymer's Northeastern Area Sales Representative *ARTHUR E. BAILEY* made the trip in the course of his rubber industry career. His years of widely varied experience equip him with a wealth of invaluable information and seasoned know-how—his services have helped a lot of Copolymer customers find important "right answers" to rubber utilization questions. If you use rubber, Mr. Bailey is a good man to know when there's a job to be done in the Northeast. He has offices in Philadelphia and Hartford, *he knows rubber,* and like all Copolymer men, he has a customer-minded, ready-to-serve outlook we believe you'll appreciate.

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Overseas

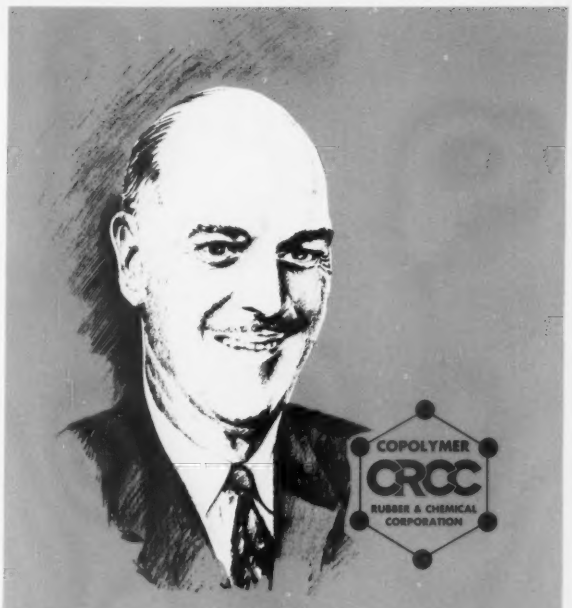
The Hague—The building of an ozone-oxidation plant for the transformation of fatty materials into plasticizers for flexible vinyl products will be the initial move of Unilever-Emery N.V., Gouda, The Netherlands, a newly formed company. The company is jointly owned by Emery Industries, Inc., Cincinnati, and Unilever N.V. The factory has acquired an existing Dutch concern, Koninklijke Stearine Kaarsenfabrieken "Gouda-Apollo," which produces basic fatty acids, and has a factory adjacent to the new plant.

Sydney—Hercules Powder Co. (Australia) Pty., Ltd., will build a plant for the production of rosin based emulsifiers for use in the manufacture of synthetic rubber, and chemicals for use in the manufacture of paper, in Springvale, Victoria. The company is owned by Hercules Powder Co., Wilmington, Del., and A. C. Hatrick Pty., Ltd., of Australia. Production is expected to start in 1961 and the emulsifiers produced will be used by the Australian Synthetic Rubber Co. under a long-term sales agreement.

New Delhi—A plant to manufacture furnace carbon black will be constructed near Durgapur by Phillips Carbon Black Ltd., a company owned by Phillips Petroleum Co., Bartlesville, Okla., Duncan Brothers & Co., Ltd., Calcutta, India, and private investors. The plant, which will have an initial design capacity of 22 million pounds per year, is scheduled to be in operation within 18 months. J. W. Barber, formerly manager of market evaluation and butadiene-butylene sales for Phillips Chemical in the United States, will be in charge of the operations and sales for the new company with offices in Calcutta.

Milan—Bataafse Petroleum Maatschappij N.V. and Montecatini Soc. Gen. per l'Industria Mineraria e Chimica of Milan have agreed to form a joint company in the Netherlands. A plant, to be built and operated in conjunction with the works of Shell Netherlands Raffinaderij N.V., will manufacture polypropylene for plastics. Montecatini patents will be utilized, and the companies of the Royal Dutch-Sheli group will handle the sale of the polypropylene products in the Benelux countries.

Rio de Janeiro—The new B. F. Goodrich do Brasil S.A. plant, which went on stream in March, is now turning out 700 tires a day. The plant, to be expanded next year, gets 60 per cent of its raw materials from Brazil.



News from the Northeast indicates that COPO® non-staining rubbers are proving particularly adaptable in the manufacture of shoe soling and heels. Copolymer high color standards result in important advantages in this field. Users report these COPO® rubbers also offer superior processing characteristics.

In applications where the regular Mooney level is desired, COPO® 1502 is meeting highest requirements consistently. For lower-cost compounds, COPO® oil-extended, non-staining polymers are filling the bill perfectly. In certain products, low-Mooney rubbers by Copolymer have proved to be the answer.

Producers of belting, hose, and mechanical rubber goods find that *Carbomix*® masterbatches, with high uniformity of carbon black dispersion, are delivering qualities they were unable to get before using this Copolymer-developed family of polymers. At the same time, they have been saving time and reducing processing costs.

Copolymer's expanded Research and Development facilities are constantly at work devising products and techniques that assist rubber users in solving problems and making increasingly superior products. Call your Copolymer sales representative immediately if you suspect there may be a "better way to do it" in *your* rubber-utilization processing situation. He can help.

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Diamond Chemicals

Akron Group Hears Program on Markets

► The Akron Rubber Group presented a program entitled, "Changing World Markets," at its Fall Meeting on October 28. Four speakers participated in the program which took place at the Sheraton-Mayflower Hotel in Akron, Ohio, and was attended by 350 members and guests. The program was under the direction of R. J. Brown (Goodyear) and included the following subjects: "Synthetic Rubber," by J. D. D'Ianni (Goodyear); "Natural Rubber," by H. C. Bugbee (Natural Rubber Bureau); "Carbon Black," by John Andrews (Cabot Corp.); and "Tire Plants," by C. W. Rippey (Firestone).

In his discussion on synthetic rubber in changing world markets, Mr. D'Ianni reviewed the production capacities for synthetic rubber of all major types in the United States and the rest of the world, including the Iron Curtain countries. He informed the group that the total world capacity for synthetic rubber production in 1960 is 2.8 million tons, which is expected to rise to 4.3 million tons by 1965. According to the speaker, a substantial portion of the increased capacity will be for the stereo rubbers, *cis*-1,4-polyisoprene and *cis*-1,4-polybutadiene. He added that by 1965, world capacity for stereo rubbers may reach 500,000 tons per year.

Synthetic Surplus

Mr. D'Ianni concluded his remarks with the statement that the worldwide surplus capacity in synthetic rubber which is now a reality, will pose a number of problems for present producers, especially those that are interested in international marketing of their products. He cautioned against being too pessimistic, explaining that the synthetic rubber producers are in an excellent position to provide the latest and most complete information to the users of their products, which are backed up with a massive, highly organized research and development effort.

The replanting and new planting program in Malaya was the principle subject of Mr. Bugbee's talk on natural rubber. In commenting on the various factors contributing to the much higher yields expected in Malaya during the coming decade, Mr. Bugbee stated that the first factor, and the most important, is the replacement of low yielding rubber with high yielding material. The second major improvement factor, according to the speaker, has been in tapping methods, and the third and last improvement, a development of the last few years, is the application of yield stimulants.

The participants in the "Changing World Markets" program held by the Akron Rubber Group. Left to right: John Andrews (Cabot Corp.); C. W. Rippey (Firestone); R. J. Brown (Goodyear), program chairman; H. C. Bugbee (Natural Rubber Bureau); and J. D. D'Ianni (Goodyear).

Mr. Bugbee devoted part of his remarks to describing the operations of the Rubber Research Institute of Malaya. He remarked that the Institute is responsible, in large measure, for the many advances made in rubber planting during the past three decades. In his conclusion, Mr. Bugbee stated that the natural rubber industry, through steady advancement toward higher yields, lower costs, and improved products, looks to the future with optimism.

In looking at the changing world markets for carbon black, Mr. Andrews began his remarks by going back to 1945 to gain an historical perspective relative to the present position. According to Mr. Andrews, the essential ingredient in the carbon black industry was the development of the oil furnace process, for this new technique and its many continuing refinements caused a complete revolution in the industry.

The speaker graphically plotted the growth of carbon black consumption, capacity, and production facilities in both the United States and foreign countries. He pointed out that the technical means have been developed so that a carbon black plant can now be built anywhere in the world where it is economically possible to do so, and the carbon black industry is doing just that, he said.

Mr. Rippey, the final speaker on

Continued on page 521

The 1960-1961 officers of the Akron Rubber Group. Seated, left to right: *Chairman*, Irvin J. Sjothun (Firestone); *Vice-Chairman*, John H. Gifford (Witco). Standing, left to right, *Treasurer*, B. N. Larsen (Naugatuck Chemical); and *Secretary*, Robert B. Knill (Goodyear).

Canadian News

► The 1960 R. S. Jane Memorial Lecture was given by E. Ralph Rowzee, president and managing director, Polymer Corp. Ltd., on November 9 during the 10th Canadian Chemical Engineering Conference in Quebec City. The subject of Mr. Rowzee's lecture was "Rubber, Research, and Human Resources." He remarked that the story of rubber is an interesting one, repeatedly emphasizing the action of the economic laws of supply and demand. In discussing the synthetic rubber program, Mr. Rowzee said that it has been called one of the major chemical engineering achievements of all time. He pointed out that of major significance was the coordination of pooled processes, and ideas of many companies, into a so-called standard plant.

The Standard Plant

According to the lecturer, the development of the standard plant is an excellent example of good chemical engineering design. He explained that there have been many pieces of equipment that, for one reason or another, operators would have liked to replace, but in spite of a real effort to find better equipment, relatively few changes have been made. He added that most basic equipment ordered for new plants today is very similar to the equipment installed in existing plants almost twenty years ago.

This does not imply, the speaker explained, that changes have not taken place. On the contrary, many improvements have been made, but these have been primarily process changes, and changes in auxiliary equipment. Mr. Rowzee said that the conversion of the copolymer reaction from a batch to a continuous process was highly important since it increased the capacity of the plant substantially. He added that new controls and instrumentation have improved uniformity and other quality characteristics; new types of rubber have been introduced to supply the specialized needs of industry. These, according to the Jane lecturer, are but a few of the changes, and in all of them can be seen the work of the chemical engineer and the chemist.

► The installation of new facilities to produce a range of black masterbatch rubbers is being planned by Polymer Corp., Ltd., Sarnia, Ontario. The new facilities, which will be located in Sarnia, will cost in excess of one million dollars, and are scheduled to be completed in the second half of 1961. According to L. D. Dougan, vice - president, operations, the addition of these facilities is part of the continuing program of growth of the Sarnia plant for increased production of existing and new products. Mr. Dougan points out that the new black masterbatch rubbers will provide important additions to the wide range of synthetic rubbers now produced, enabling the company to continue to supply the rubber requirements of the Canadian industry, and to maintain its world position.

► The Division of Rubber Chemistry, Chemical Institute of Canada, will present a one day program of technical papers on August 4, 1961, during the annual conference of the Institute at the Queen Elizabeth Hotel in Montreal, Quebec. The program for the morning session will consist of general papers, and the afternoon session will feature papers on textiles as applied to the rubber industry. Persons interested in submitting papers for participation in the Rubber Division sessions should contact C. M. Croakman, Columbian Carbon (Canada) Ltd., 7 Superior Avenue, Toronto, Ontario, Canada.

► Three Canadian plastics groups, the Society of the Plastics Industry of Canada, the Society of Plastics Engineers of Ontario, and the Society of Plastics Engineers of Quebec, are reported to be considering their amalgamation into one group. A fact finding committee has recommended that a vote of each group's membership be taken in order to ascertain the advisability and acceptability of such a merger.

► Dow Chemical, Sarnia, Ontario, has begun engineering on a plant to produce polypropylene resins. According to the company, the process will be complementary to that being used to produce linear polyethylene.

Goodrich Fellows Named

► Dr. David Craig and Dr. Forest W. Shaver, scientists on the staff of the B. F. Goodrich Company Research Center, in Brecksville, Ohio, have been named research Fellows, a new assignment category instituted by the company. Goodrich scientists in the new research Fellow category are free to explore fundamental research projects of their choice which are in line with the research and development policy of the company. Dr. Craig was formerly a research associate and has had a variety of research assignments, and Dr. Shaver was formerly senior scientist directing research on rubber chemicals and polymer derivatives.

Dr. Craig received a B.S. degree in chemistry from Des Moines University in 1925 and a Ph.D. in chemistry from State University of Iowa in 1928. He joined Goodrich in 1928 and has held a variety of research assignments there. Dr. Shaver attended Bridgewater College and the University of Virginia where he received his Ph.D. in chemistry in 1941. He joined the B. F. Goodrich Co. in 1942.

Copolymer Building Slated

► Plans for the construction of a $750,000 office building in Baton Rouge, La., have been announced by Copolymer Rubber and Chemical Corp., Baton Rouge, La. The building will cover 25,000 square feet and will be a two story, open type structure of contemporary design. A basement in the building will house all mechanical and electrical equipment, and executive and administrative offices will also be located in the building. All exterior walls will be constructed of pressed steel frames and glass window walls with opaque glass exterior panels. Vertical blinds will be installed behind the windows, and exposed steel columns will be faced with ceramic tile.

New Witco Assignments

► Richard H. Dorsett and Robert Stevenson have been given new sales assignments by the Organic Chemicals Division of Witco Chemical Co., New York, N. Y. Mr. Dorsett, formerly with the division's sales force in Dallas, Texas, has been appointed Southwestern sales manager with headquarters in Houston, Texas. Mr. Stevenson has been transferred from Houston to Dallas.

Continued from page 519

the program, stated that simple tire plants are a thing of the past. He explained that automation is necessary not only to take advantage of each man-minute but to improve the quality of the tire. According to Mr. Rippey, 1 million tires a day are being produced by 191 tire plants located in 51 countries. Of this number, he added, 42 factories in the United States produce more than half of this total, while England with 9, and France with 8 plants, account for 56,000 tires a day, and Russia turns out 14,000 tires daily in 8 factories.

He emphasized that trends in tire manufacture will certainly follow trends in automotive production. World production of cars, trucks, and buses, he stated, progressed from 12 million in 1955 to 13 million in 1959. He pointed out that North American automotive production shows little increase, while most foreign auto plants are increasing output every year. As examples, he remarked that West Germany produced 100 per cent more units in 1959 than it did in 1955, English automotive production increased 72 per cent, and French, 70 per cent during the same period, while United States production, during that same time, declined by 26 per cent. Mr. Rippey stated that the increased foreign automotive output has already created a need for expanded tire production in foreign areas, and 9 new tire plants are being built now in foreign countries.

Texas Butadiene Stock

► Texas Butadiene and Chemical, Channelview, Texas, has announced plans to issue 635,800 shares of common stock, in addition to the 2,053,200 shares now outstanding, in part to pay for foreign projects. Nearly 300,000 of the new shares will be offered to the public by an underwriting group headed by Blyth and Co. and Lehman Brothers, at a price of approximately $20 a share. The balance will go to present stockholders. Currently Cabot Corporation owns about 43 per cent, and two New York investment companies, Carl M. Loeb, Rhoades and Co., and Salkeld and Co., another 43 per cent. Texas Butadiene has a $38 million investment in two plants to be built in France, in conjunction with Société des Elastomers de Synthese, a jointly owned company. Last year Texas Butadiene got permission from the Argentine government to put up a synthetic rubber complex in southern Argentina, an $18 million project.

LOOK TO

Taylor-Emmett

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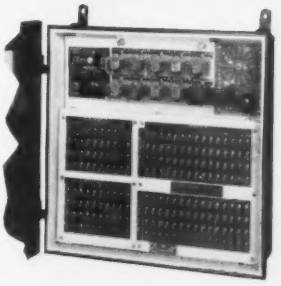

Type RM88015 ROBOTRON* Timer. Matrix circuitry minimizes wiring while permitting more functions and simplified mechanism. This timing control for plastic molding presses is so simple that cycle sequences can be set up in as little as 10 seconds without particular skill or familiarity. Makes all press operations fully automatic from start to finish.

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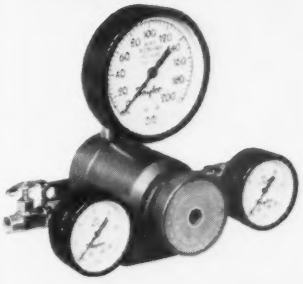

New 395R Indicating Pressure Controller. Extremely sensitive to slight pressure changes. Offers excellent readability, precise set point adjustment and an adequate Sensitivity or Proportional Band adjustment. Can be mounted on top or at the side of a valve. Available with brackets for mounting on valve actuator, valve body or on a panel.

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Obituaries

Edward H. Lewis

► Edward H. Lewis, president and founder of Western Insulated Wire Co., Los Angeles, Calif., died of a heart attack at his home in Brentwood, Calif., on October 4. He was 63 years old. Mr. Lewis graduated from Cornell University in 1921 with a degree in mechanical engineering. He was chief engineer designer of conduit wires and cables for General Electric Co. in Schenectady, N. Y., and Bridgeport, Conn., for 12 years. Next, he was general manager of the Hatfield Wire and Cable Co., Newark, N. J., for two years. In 1937 he founded Western Insulated Wire Co. In 1959 the company was purchased by Penn-Union Electric Corp., Erie, Penna., with Mr. Lewis continuing as president.

Under his direction the company had grown to be perhaps the largest of its kind west of Chicago. Mr. Lewis is credited with many inventions and held many patents, particularly in the field of electrical wire and cable. He was one of the first manufacturers to use neoprene as a protective covering on standard industrial electrical cords. He is survived by his wife and a daughter.

E. M. Paschall

► E. M. "Pete" Paschall, formerly chief chemist at Crescent Insulated Wire and Cable Co., Trenton, N. J., died July 17. Mr. Paschall was born in Wilmington, Del., on May 16, 1906. He graduated from Lehigh University with a degree in chemical engineering in 1929, and from there went to Crescent where he remained as chief chemist until 1937. He next became affiliated with Solar Compounds and Solar Varnish Companies, retiring in December, 1957. At the time of his death he was residing in Dauphin, Penna. He is survived by his wife and two children.

William B. Brewer

► William B. Brewer, president and chairman of the board of Cooper Tire & Rubber Co., Findlay, Ohio, died September 14 in his office of a heart attack. He was 60 years old. He is survived by his wife, two daughters, and five sons.

Charles R. Haynes

► Charles R. Haynes, for many years secretary of the Rubber Division of the American Chemical Society and the author of numerous papers dealing with the chemistry and application of carbon blacks, died November 21 at the home of his brother in Boxford, Mass., after a lingering illness. He was 78 years

old. Holder of a B.Ch.E. degree from the Massachusetts Institute of Technology, he served as a chemist for the Boston Rubber Shoe Co., as foreman and research chemist for the Boston Woven Hose and Rubber Co., chief chemist and assistant superintendent for the Mechanical Rubber Co., and factory manager for the Goodyear Metallic Shoe Co.

Mr. Haynes also was associated with the U. S. Rubber Co., New York, N. Y., as an assistant purchasing agent in New York, and was connected with latex development in Naugatuck, and hose development in Passaic. He joined the Binney and Smith Co. as rubber technical service manager in January 1935, retiring in 1955. In recent years he was a consultant chemist for National Polychemicals of Wilmington, Mass. Survivors are a brother and a sister.

Wilbur E. Colville

► Wilbur E. Colville, retired president of the General Coating Co., Woodbridge, N. J., died June 26 in his home in Fanwood, N. J. He was 57 years old and is survived by his wife.

Charles H. Churchill

► Charles H. Churchill, associated with Stoner Rubber Co., Anaheim, Calif., died September 2. He was active in the rubber industry in Southern California for 28 years. In the 1930's he was with the Tire Division of U.S. Rubber in Los Angeles. In 1939 he joined H. Muehlstein and Co., serving in the Los Angeles and Akron, Ohio areas. In 1941 he was with the War Production Board in Washington, D. C. for a short time, then joining the B. E. Daugherty Co.

Next he helped form, and became a partner of, Sterling Rubber Products Co., Los Angeles. More recently he was with American Latex Fibre Corp., Hawthorne, Calif., and California Rubber Products, Torrance, Calif. He was active in the Los Angeles Rubber Group (TLARGI) and was chairman of that group in 1949. He is survived by two sons, both with the Naugatuck Chemical Division of the U. S. Rubber Co., New York, N. Y.

Richard T. Griffiths

► Richard T. Griffiths, a former sales manager at B. F. Goodrich Co., Akron, Ohio, died October 16 at City Hospital in Akron, after many years of failing health. He was 84 years old. Mr. Griffiths joined Goodrich at the age of 16 and became assistant to the inventor, John Gammeter. For 18 years he assisted in the development of rubber tires for the automobile. In 1908 he became general superintendent of the Miller Rubber Co., later becoming president and factory manager. When the firm merged with Goodrich, he remained as Goodrich sales manager until his retirement in 1941. Mr. Griffiths is survived by his wife, a daughter, and a grandson.

Clarence Blumoehr

► Clarence Blumoehr, assistant to the president of Phelps Dodge Copper Products Corp., New York, N.Y. died September 26 at his home in Long Island. He was 58 years old. Mr. Blumoehr joined the Habirshaw Cable and Wire Corp., later acquired by Phelps Dodge, in 1918. He was director of the wire mill branch office of the Copper Division of the National Production Authority in Washington during the Korean conflict. Mr. Blumoehr is survived by his wife, two daughters, and two grandchildren.

R. F. Dunbrook

Retires at Firestone

► Dr. Raymond F. Dunbrook, who played a part in the discovery of Coral and Diene, has retired after 31 years at the Firestone Tire and Rubber Co., Akron, Ohio. Dr. Dunbrook, assistant research director of the company for 15 years, is known for his translation of "The Science of Rubber," by Professor D. K. Memmler, and a comprehensive paper in which he reviewed the government research program on synthetic rubber from the viewpoint of the organic chemist. Dr. Dunbrook has had a hand in six patents; was co-editor of "Synthetic Rubber," a book; and has written numerous articles.

He was graduated from the University of Michigan in 1917 with a B.S. degree in chemical engineering. After spending three years as a research and control chemist with the Holland Aniline Co., Holland, Mich., he received an M.S. in 1921 and a Ph.D. in organic chemistry in 1923, at the University of Pittsburgh. He was head of the Chemistry Department at Wittenberg College from 1923 to 1929. He joined Firestone in 1929 as a research chemist and was soon named head of the organic chemicals group. He became assistant director of the research laboratories in 1945.

Sperry Names Gordon

► E. D. Gordon has been appointed assistant to the president of the Sperry Rubber and Plastics Co., Brookville, Ind. He was formerly with the Firestone Industrial Products Division of the Firestone Tire and Rubber Co., Akron, Ohio. Mr. Gordon joined Firestone in 1941 and since then has been connected with their Industrial Products Division.

Antara Surfactants

► A new series of surface active agents, to be sold under the trademark Gafac Surfactants, has been introduced by the Antara Chemicals Division of General Aniline and Film Corporation, New York, N. Y. The anionic surfactants will have application in the following fields: emulsion polymerization, textile, heavy duty liquid detergent cleaning compound, agricultural, metal cleaning and dry cleaning.

Gafac GB520, RE610, LO529 and PE510, are now commercially available, and two others, Gafac RM510 and RM710 are being readied for the market. Of these, Gafac PE510 and RE610 are useful in the emulsion polymerization of acrylate monomers, and it is said that they may be used to advantage in the preparation of acrylonitrile and butadiene - styrene emulsions and other vinyl-type emulsions. Among the advantages claimed when the Gafac surfactants are used in place of a sulfonated anionic surfactant and a nonionic surfactant are film clarity, light stability, heat stability, buffering action, corrosion resistance, and low residual monomer contact.

Firestone Cording Nylon

► Production of nylon filament for use in tire cord is underway at the Firestone Synthetic Fibers Co. plant in Hopewell, Va., making Firestone the first American rubber company to produce its own nylon filament. With the opening of the division, the Hopewell facility is producing both monofilament and multifilament nylon yarns which will be processed further for tire cord at the company's textile plants. When in full production, the plant will produce 10 million pounds of nylon annually. It has been extensively modernized and expanded since purchased last year.

Hughes Rubber Specialist

► Oscar Dobkin has joined the Applications and Evaluation Section of the Materials and Processes Department, Product Effectiveness Laboratory, of Hughes Aircraft Co., Los Angeles, Calif., as a member of the technical staff with responsibility for consultation and design support in the field of rubber and elastomers. A graduate of Kent State University, Mr. Dobkin has 13 years experience in the rubber field. He is a member of the Los Angeles Rubber Group and of the Rubber Division of the American Chemical Society.

Kenneth H. Barratt

To Head Regional Sales

► Kenneth H. Barratt has been named regional sales manager for the North Eastern United States area for the Chemical Division of International Latex Corp., Dover, Del., with responsibility for serving all consumers of the company's Tylac latices, produced by the company's polymer plant at Dover, Del. With the opening of a new regional office in the Boston area, the company will, according to Arthur Nolan, general sales manager of the division, be able to improve service to present customers and concentrate on establishing new accounts in such fields as non-wovens, paper saturation and coating, dipping, textiles, leather finishing and general compounding. Mr. Barratt holds a chemistry degree from Wesleyan University in Middletown, Conn. Most recently with the Naugatuck Chemical Division of U. S. Rubber Co., New York, N. Y., he has had ten years experience in the synthetic and natural latex fields.

Sto-Chem Plant Designed

► The design of a $2.5 million latex plant to be built by Sto-Chem, Ltd., of Stoke Prior, Worcester, England, has been completed by Crawford and Russell, Inc., Stamford, Conn. Sto-Chem is jointly owned by U. S. Rubber Co., and Witco Chemical Co., both of New York, N.Y. Crawford and Russell worked in cooperation with the engineering staff of the Naugatuck Chemical Division of U.S. Rubber in designing the plant. Capacity will be 8 million pounds per year and a variety of butadiene, styrene, and acrylonitrile latices will be produced.

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New Goods

Pak-A-Way Work Rubber

► The new Pak-A-Way work rubber developed by U.S. Rubber Co., 1630 Avenue of the Americas, New York, N. Y., to go over work shoes, is said to be lightweight, flexible, comfortable, tough, and surefooted. According to the company, the secret of its fit is a deeply corrugated

pliable shank which stretches so the overshoe fits easily over any type of work shoe. Pak-A-Way is waterproof and is made of a tough, amber translucent material that is durable and washable. Its tough, anti-skid sole adds safety and surefootedness in working on wet, slippery surfaces, including fats, greases and oils. Pak-A-Way comes in four sizes—extra large to fit men's work shoes 12 to 14; large to fit 10 to 12; medium to fit 8 to 10; and small to fit 6 to 8.

Quick-Change Dry Box Gloves

► Sure-Lock Dry Box Gloves have been introduced by the Surety Rubber Co., Carrollton, Ohio, to provide greater convenience and less costly glove replacement in dry box operations. Available in rubber, neoprene and Sureseal, the gloves are designed to provide a quick-change, two-part unit for replacement of gloves without disposing of the costly sleeves. An interlocking ring and groove system enables the operator to change gloves without removing the sleeve from its fastened-on position in the port opening of the dry box. For applications requiring a completely air or gas-proof seal, a double ring seal is available. The gloves are made in 27 and 30 inch over-all length with 5 or 8 inch I.D. opening. All size gloves fit either sleeve, and thicknesses can be varied to conform to specific requirements.

Quick answers to everyday problems on the major synthetic rubbers

SYNTHETIC RUBBER TECHNOLOGY

By W. S. Penn, B. Sc.

5½ x 8½ in. 326 pp. $8.50

Here, in Volume I of a two-volume series, is the first practical textbook devoted to the compounding and processing of the major synthetic rubbers . . . major from the standpoint that they are standard polymers whose techniques, although they will obviously change, will change more slowly than other synthetic rubbers not covered in the first volume. The newer materials will be covered in Volume II.

Elastomers covered in the current work include SBR, butyl rubber, neoprene, nitrile rubber, silicone rubber, Thiokol and high styrene resins. Modern and practical compounding techniques are given. Actual results are shown in the form of tables rather than the stylized results usually given in curves. Illustrations are not included since the book is not an elementary exposition of compounding and processing methods.

The author, Dr. Penn, is a graduate of London University and has spent all his working life in the rubber industry. He has specialized in synthetic rubbers, with many years experience in all branches of the industry. At present, he is Manager of the Synthetic Rubber and Plastics Division of Richard Klinger, Ltd., of England.

This book is a joint publication of Maclaren & Sons, Ltd., of London, England, and the Palmerton Publishing Co., Inc., of New York. Volume II, covering the newer synthetic rubbers, will be available within the next several months.

Partial Table of Contents

General Laboratory and Factory Practice

Choice of Polymer

Compounding and Processing of SBR

SBR in Tires and Other Products

Compounding and Processing of High Styrene Copolymers

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Compounding of Neoprene

Processing of Nitrile Rubbers

Fabrication of Silicone Rubber Products

Processing, Properties and Applications of Thiokol

Applications of High Styrene Copolymers

Special Properties of Nitrile Rubbers and Their Uses

Nomenclature of Various Polymers

Compounding of Special Neoprenes

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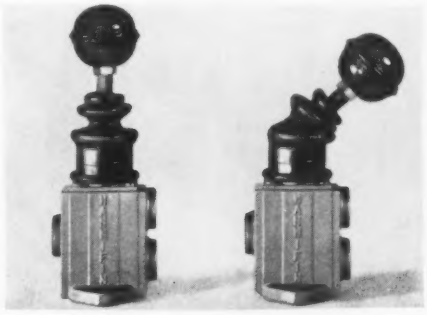
Stamford, Conn.

Hannifin Rubber Dust Boot

► A snug-fitting, wear resistant synthetic rubber boot, said to provide maximum protection for hand valve actuating mechanisms against dirt and moisture is being produced by Hannifin Co., Dept. 366, 501 S. Wolf Road, Des Plaines, Ill. The



boots are reported to keep dirt out of the hand toggle assembly without hampering normal valve operation, and are particularly suited for outdoor service, foundry applications or wherever moisture and dust are a problem. The rubber boots, according to the company, extend valve life while reducing maintenance and downtime.

Protective Corset for Pilots

► Engineers of Goodyear Aircraft Corporation, Akron, Ohio, have developed a restraining system of inflatable bladders, netting and straps that will draw a pilot tight in his capsule during a high altitude escape from an aircraft which is in trouble. The corset was developed for the Wright Air Development Division of the Air Research and Development Command of the Air Force, and it can be adapted for any of several advanced flight vehicles. After a pilot pushes the emergency escape button, straps on his shoes draw his feet inside the escape capsule; bladders around his legs, arms, body and head inflate; and netting becomes taut. The capsule doors close and the escape unit is pressurized, air-conditioned and ejected. As the capsule descends, parachutes open.

Goodyear Fuel Oil Hose

► A new, non-marking fuel oil hose, designed for maximum resistance to the swelling and softening effects of fuel oil, has been developed by Goodyear Tire & Rubber Co., Akron, Ohio. Called Redwing and Blackwing fuel oil hose, depending in its cover's color, the new product features a Chemigum tube that is said to remain flexible at —40°F. The company reports that a new Neoprene cover represents an optimum of oil, weather and abrasion resistance and ease of handling, and the elimination of static bonding wire adds to its over-all durability.

Weblite Woven Webbing

► A new fencing material, being produced and marketed by Weblite, Inc., Mineola, L. I., N. Y., consists of strips of webbing woven of plastic filaments, which are interlaced between posts of redwood, cedar, or aluminum. The product, known as Weblite, is woven of Velon, a seran monofilament extruded by Firestone Synthetic Fibers Co., Pottstown, Penna. The base polyvinylidene chloride resin from which it is made is produced by Dow Chemical Co., Midland, Mich. Weblite is said to provide a fence that is strong, durable, and weather resistant. The Velon filament from which it is made is a solid strand, and therefore is completely non-absorbant and impervious to moisture. According to the company, Weblite has an extremely high tensile and impact strength, so that wind and hail have no effect, and it does not deteriorate from sunlight, mildew, insects, or any of the other usual ravages of exposure.

Fish and Clam Suction Hoses

► A new line of hoses designed for the fishing industry and including two major types of fish suction hose and a high pressure clam jet hose, has been announced by the Goodyear Tire & Rubber Co., Akron, Ohio. The style LW lightweight fish suction hose is designed primarily for unloading of fish nets at sea. It has a spirally fluted cover for light weight and flexibility, which is said to make it useful at docks when severe cover abrasion is not a factor. The style HD heavy-duty fish-dock suction hose will reportedly handle dock unloading of boats and will serve as flexible sections in fish transport lines in canneries and processing plants. Its smooth cover is said to afford better resistance to severe abrasion. The style HP high pressure clam jet hose is for use in dislodging clams from the ocean floor, and has a tough abrasion-resistant tube and cover.

Saf-Pla Surfacing Material

► A new surfacing material called Saf-Pla has been developed by U.S. Rubber Reclaiming Co., Inc., P.O. Box 365, Buffalo 5, N. Y. The new product is made from prepared crumb rubber and, after being mixed with asphalt, is raked out and rolled. According to the company, Saf-Pla is being used for such applications as: surface covering for play areas under swings, seesaws, jungle gyms; for tennis and handball courts; for horse walkways at racetracks, running paths for pole vault and high jump events; and around children's wading pools and swimming pools. It is said to reduce the hazards of falls and to minimize injuries, and can be used in all kinds of weather.

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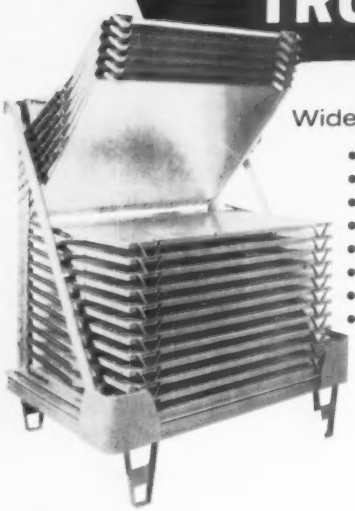

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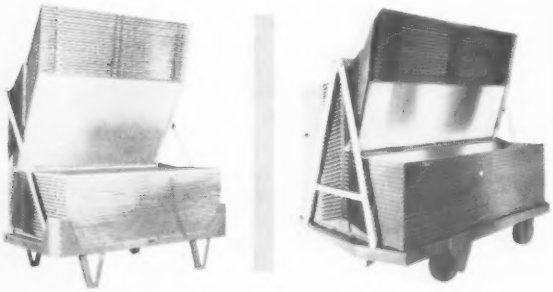

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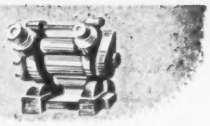
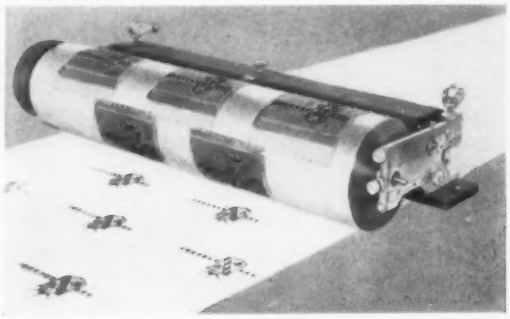


Gottscho Printer

► Adolph Gottscho, Inc., Hillside 5, N. J., has introduced an automatic continuous printing attachment that can be set up as part of an existing production operation to print on almost any kind of material. Designated the 900-H Rolaprinter, the unit is designed for do-it-yourself mounting to winding, coating and similar processing machines in which material is handled in



continuous web or sheet form. Models are made to imprint designs, trademarks, and other legends ranging from 1 to 36 inches wide on paper, board plastic, fabric, linoleum, sheathing, wallboard, gasket material, metal, and other difficult surfaces. Prints can be made in almost any desired color, including white and yellow. The printer is said to be a simplified version of rotary printing presses which use fast-drying fluid inks, and is designed for completely automatic operation. According to the manufacturer, a special feature of the 900-H Rolaprinter is its ability to accommodate printing cylinders of any circumference between 11 and 30 inches, permitting accurate register of impressions at any desired interval.

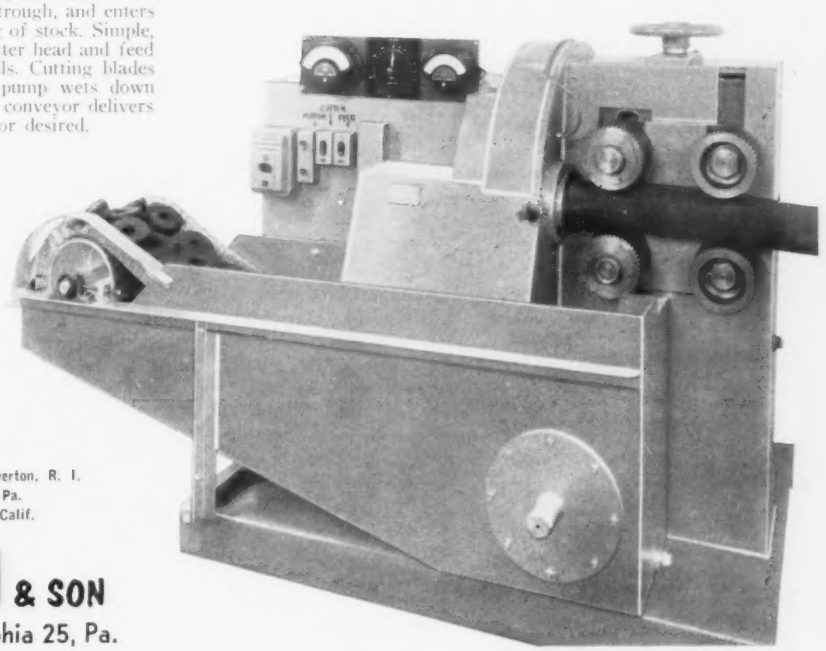
Despatch Heaters

► A new line of heaters designed for do-it-yourself applications in the rubber and other industries is available from Despatch Oven Co., 619 S. E. 8th St., Minneapolis, Minn. For use in aging, curing and other processes, the heaters employ gas, oil or electricity and are rated from 150 thousand to 3 million btu and 8 to 360 kw. The new line is said to provide up to 900°F. delivered air when gas or oil is used, and 550°F. delivered air with electricity. The heaters are available singly for custom-engineered applications, or can be had in complete packaged systems. Also available are specially-designed systems and components according to specification.

GOODMAN 6" Capacity SLUG CUTTER

The Goodman Model 6-24 Cutter is a rugged, accurate unit for producing large slugs (up to 6" dia.) from uncured rubber. In a normal installation, material leaves the extruder, passes through a cooling trough, and enters the Cutter directly, eliminating handling of stock. Simple, easy-to-reach controls vary speed of cutter head and feed rolls, and feeding pressure between rolls. Cutting blades (4 furnished) are hardened steel. A pump wets down material at the cutting point. A built-in conveyor delivers stock to any receptacle or other conveyor desired.

Rubber Slugs up to 6" dia., 1/4" to 24" long



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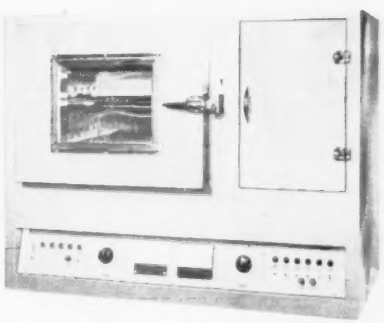

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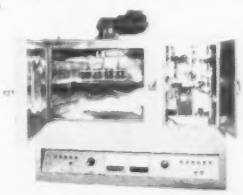

Orec 0300 with Dynamic Stretching Apparatus. *(patent pending)*

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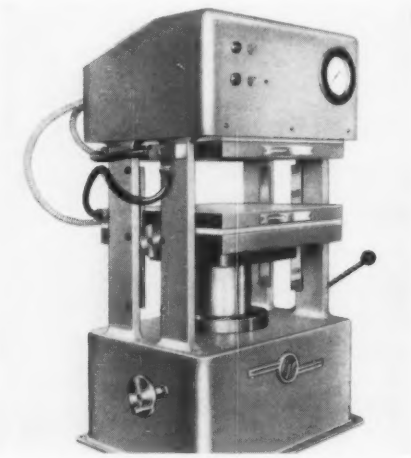
75-Ton Hydraulic Press

►Kingsbacher Murphy Co., 9830 Bellanca Avenue, Los Angeles, Calif., has manufactured a 75-ton hydraulic press that can be used for molding laminating, or testing of rubber and plastic materials. The platens have a surface area of 19 by 19 inches, are electrically heated, and are furnished for steam heating or water cooling.



Every platen has it own adjustable thermoswitch connected to its own highly sensitive mercury relay. The combination of thermoswitch and mercury relay is said to accurately control the platen temperature to 600°F. The press has a four column welded steel frame which provides precision self alignment and self leveling of the platens. The daylight opening between platens varies from zero to 11 inches, and a removable adapter is standard equipment which allows for a daylight opening from zero to 6 inches, or from 6 to 11 inches. A variety of hydraulic units are offered for closing platens and raising pressure and both manual and motorized pumps are available. Also available are special pressure test gages, heat control units and other accessories.

TMI Notching Cutter

► A new cutter which notches one or more Izod specimens simultaneously has been introduced by Testing Machines, Inc., 72 Jericho Turnpike, Mineola, N. Y. Samples are automatically positioned in the cutter for proper depth and position of notch. A fixture on the machine base provides for samples being placed on a knife edge support and depth of cut is automatically registered on a dial indicator. This apparatus is said to speed up preparation of notched Izod impact samples. Linear speed of the cutter wheel meets with ASTM suggested speeds. By moving a convenient lever, as many as five samples are notched simultaneously.

Electric Drum Heater

► A new flexible electric drum heater for heating viscous materials and simplifying their removal has been introduced by Electro-Flex Heat, Inc., 83 Woodbine St., Hartford 6, Conn. The heater, designed to fit any diameter steel drum from 21½ to 23½ inches, is said to be ideal for users of plastics, paints, molasses, oils, greases, fats, adhesives and chemicals. The unit is flexible and can be wrapped around the drum and easily connected with a simple spring attachment. Once in position, the device will heat the drum and its contents to any desired temperature to permit easy and economical removal of the contents or maintain even temperatures when required. The heater is made from fully vulcanized silicone rubber, fibre glass, cloth and metal screen laminate, and is highly resistant to mechanical damage. Its flexibility permits snug wrapping of the drum even when both drum ends are restricted. The heater band is 2½ inches wide and one or more units can be used, depending upon temperatures required. The heater is factory tested at 1250 volts dielectric strength and is rated 1000 watts at 115 volts. Special sizes are available on request.

Trost Jet Mills

► Trost jet mills, distributed by Engineered Materials, P.O. Box 363, New York 8, N. Y., have been designed to eliminate the dangers of contamination in grinding. The company reports that the usual jet mills often contaminate the material being ground because of the abrasion of the walls of the grinding and collecting chambers. However, the Trost mills are said to eliminate the contaminations from these points by proper linings. The parts subject to the most abrasive action can be made of alloy steel, silicone, tungsten, boron carbide, ceramics, rubber, or other materials. The Trost jet mills are available from large production sizes of tons per hour to laboratory mills that will grind as little as one pound per hour. The results obtained on the laboratory mills can be duplicated in the production mills as the basic design and proportions are identical.

CORRECTION

On page 364 of the November, 1960, issue of RUBBER AGE, there appeared a description of the Series 250 Hydraulic Presses manufactured by the Atlas Hydraulics Division of the Delaware Valley Manufacturing Co. Inadvertently, the wrong illustration accompanied the text material. The photograph accompanying the item actually shows the Wallace Shawbury Curometer, distributed in the U. S. by Testing Machines, Inc., Mineola, L. I., N. Y. We regret the error.

Need a rotary joint?

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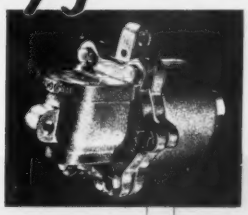

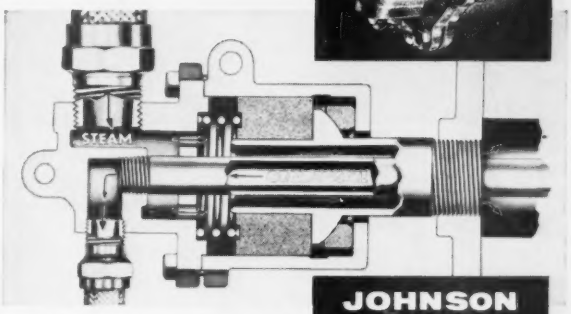

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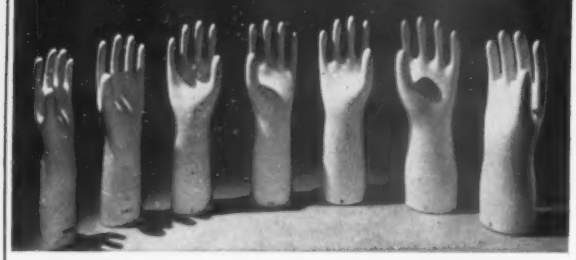

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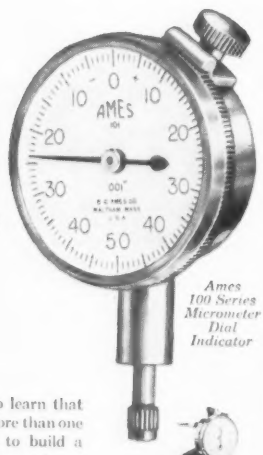

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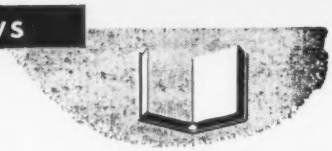
Reviews



Analytical Chemistry of Polymers, Part 1, Analysis of Monomers and Polymeric Materials: Plastics, Resins, Rubbers, Fibers. Edited by Gordon M. Kline. Published by Interscience Publishers, Inc., 250 Fifth Avenue, New York 1, N. Y. 6 x 9¼ in. 666 pp. $16.50.

In the field of high polymers, descriptions of analytical methods have been very scattered. This book brings together authoritative accounts of methods for assay and impurity determination in monomers, and characterization and determination of chemical and physical properties of polymers. Part 2 will deal with molecular structure determination, chemical group analysis, and identification procedures for polymers.

Progress in the science and technology of high polymers has been intimately linked to the development of modern analytical tools suitable for the unraveling of the complex compositions and structures of macromolecules. As Lord Kelvin said about the fundamental relationship between knowledge and measurement, "When you can measure what you are speaking about and express it in numbers you know something about it; but when you cannot measure it . . . you have scarcely . . . advanced to the stage of science." This book has been planned to unify scattered research reports, unpublished company specifications on inspection and control, and laboratory procedures.

Professional workers in the many industrial areas in which resins and rubbers are used will find this book extremely valuable. Special chapters have been included to deal with the identification and analysis of plasticizers, ion exchange resins, textile fibers, natural and synthetic rubbers, protein polymers, natural resins, and drying oils. Generally, procedural details are supplied for the analyst only in the case of previously unpublished tests or modifications of well-known tests. Principal features of the method and equipment are presented in abbreviated form and the reader is referred usually to the original literature for detailed directions.

■

Brimstone: The Stone That Burns. By Williams Haynes. Published by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, New Jersey. 5⅝ x 8⅜ in. 308 pp. $5.95.

This book tells the exciting story of the American sulfur industry, from the earliest pioneering days in the Louisiana swamps through the years of struggle and competition at home and abroad, right up to today's important new sulfur recovery developments in France and Canada.

The author, who has visited all but two of the sulfur operations on the Gulf Coast, knew many of the sulfur pioneers, and he has filled his narrative with the vivid detail of first-hand recollections—stories of the early companies, and of the men who built the industry; stories of smart traders in mineral rights, of rugged financiers who backed sulfur against long odds, and of the resourceful engineers who built plants in the sea of sticky gumbo, miles from town or railway.

This book, based on a work published in 1942 entitled "The Stone That Burns," contains numerous illustrations, including priceless photographs of the original Frasch operations at the pioneering Union Company. Here is a valuable and interesting history of one of this country's vital industries—absorbing reading for everyone concerned with the dynamic growth and development of American business enterprise.

BOOKLETS, CATALOGS, etc.

Carbon Blacks for Paint. Special Blacks Division, Godfrey L. Cabot, Inc., 125 High St., Boston 10, Mass. 8½ x 11 in. 16 pp.

This booklet describes the line of carbon black pigments available from Godfrey L. Cabot, Inc., for use in the protective and decorative coatings industry. It provides general information on how to select and disperse the proper carbon black grade for a particular application, and covers carbon black characteristics by group as well as individual black differences. A chart shows typical properties for all the company's paint blacks, and a section is devoted to packaging details.

•

Technical Data Bulletin on Release and Separating Papers. Riegel Paper Corp., 260 Madison Ave., New York 16, N. Y. 8½ x 11 in. 4 pp.

This bulletin comes in the form of a file folder which describes various types of release and separating papers as well as the coatings required for a wide variety of applications. Such papers are used with polyvinyl ether masses, synthetic rubber and natural rubber adhesives, as well as for film castings, container liners and for interleaving caulking compounds and other tacky materials.

•

Tenamene 3. (Bulletin #I-107). Eastman Chemical Products, Inc., Kingsport, Tenn. 8½ x 11 in. 16 pp.

The applications of Tenamene 3 (2,6-di-tert-butyl-p-cresol) as an industrial antioxidant are discussed in this brochure. Performance charts and graphs illustrate the effectiveness of the product as an antioxidant for such materials as lubricating oils, turbine oil, paraffin wax, motor and aviation gasolines, rubber, paints, elastomers, polyethylene, and insecticides. Other miscellaneous industrial applications are described and complete data on the physical properties of Tenamene 3 are presented in tabular form.

•

Paracril Nitrile Rubbers. (Technical Bulletin No. 5 Revised). Naugatuck Chemical, Naugatuck, Conn. 8½ x 11 in. 24 pp.

Revised to include Military Specifications MIL-R-3065(Ord) Amendment No. 1 and MIL-STD-417(Ord), this bulletin presents Paracril compounds designed primarily to meet these specifications. The recommendations presented are mainly intended to serve as a basis on which the compounder may build in working out problems in the field of fuel and oil resistance.

•

General Electric Liquid RTV Silicone Rubber. (Bulletin S-3). Silicone Products Department, General Electric, Waterford, N. Y. 8½ x 11 in. 12 pp.

Applications and advantages of G-E liquid RTV silicone rubber are treated in this illustrated booklet. Among the applications covered are use in electronic and electrical assemblies, suitability for aircraft and missiles, and utilization as a flexible mold material. The company recommends the product for sealing and caulking, coating, bonding, printing, patching or repairing, and for use as a dental impression compound.

•

Riegel Electrical Papers. Riegel Paper Corp., 260 Madison Ave., New York, N. Y. 8½ x 11 in. 4 pp.

This folder contains technical data on electrical papers produced by Riegel. It includes product information on different categories, such as insulating, conductive, impregnated and synthetic fiber papers. Some of the special end uses covered are core material, layer and turn insulation, laminating base, cable wrapping and electrographic copy. The folder also lists Riegel's production and electrical testing facilities.

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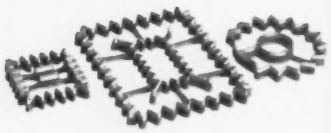

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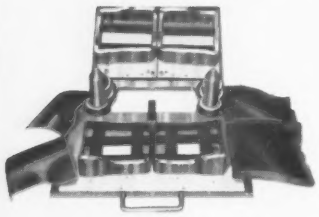

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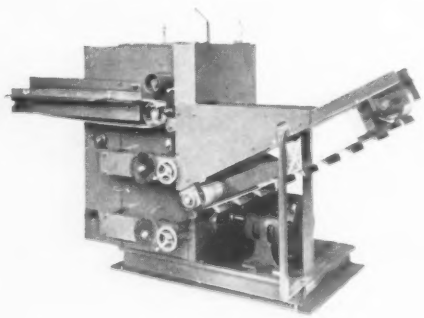

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Vistanex Polyisobutylene: Properties and Applications. (Bulletin V-01.) Butyl Division, Enjay Chemical Co., 15 West 51st St., New York 19, N. Y. 8½ x 11 in. 24 pp.

The packaging, processing and handling, properties, and application of Vistanex polyisobutylenes is covered in this concise, comprehensive booklet. The section on packaging discusses how the several grades of Vistanex are packaged, and why they are so packaged. The physical, chemical and electrical properties of Vistanex are also given wide coverage. Also included are data on such applications of the products as adhesives; caulking and sealing compounds; wax—Vistanex blends; polyethylene—Vistanex blends; rubber—Vistanex blends; tank lining and sheeting; chewing gum; Vistanex emulsions; and asphalt—Vistanex blends.

•

Product Directory. Chemical Division, Goodyear Tire & Rubber Co., Akron 16, Ohio. 8½ x 11 in. 12 pp.

The purpose of this directory is to acquaint readers with the materials and services offered by the Chemical Division. The materials covered in the booklet are utilized by the rubber, plastic, textile, paint, paper, and adhesives industries. Data are presented on the products produced by the Rubber and Rubber Chemicals Department; Adhesives Department; Coatings Department; Plastics Department; and Polyester Department.

•

Stauffer Chemicals . . . Everywhere. Stauffer Chemical Co., 380 Madison Ave., New York 17, N. Y. 5¾ x 8¼ in. 64 pp.

This comprehensive booklet, published in Stauffer's 75th year, contains descriptions, uses, and illustrations of a number of the firm's products. Covered are such products as: sulfur and sulfur compounds; mineral acids; phosphates, phosphorus chemicals, formates and oxalates; agricultural chemicals; chlorinated solvents; electrochemical products; metal chlorides; boron products; coagulants; animal products; research and specialty chemicals; and other Stauffer products. Also included is a brief history of the company and a map and listing of the company's offices, plants, associated company plants, and mines and deposits.

•

Over 60 Chemicals for the Rubber Industry. Naugatuck Chemical, Division of United States Rubber Co., Naugatuck, Conn. 8½ x 11 in. 16 pp.

This newly published brochure describes briefly the more than 60 chemicals manufactured principally for the rubber industry by Naugatuck Chemical. Several of the chemicals mentioned have found use in other application, such as: blowing agents for plastics; and antioxidants for plastics, petroleum, and other hydrocarbons. Each chemical listed is more completely discussed in a Technical Bulletin or Compounding Research Report which are available from the company. The brochure should be helpful in research, development and compounding work.

•

Philblack in Natural and Synthetic Rubbers. (Bulletin P-21.) Rubber Chemicals Division, Phillips Chemical Co., 318 Water St., Akron, Ohio. 8½ x 11 in. 56 pp.

This brochure on the Philblack carbon blacks describes the manufacturing process, the physico-chemical and reinforcing properties, the moisture absorption characteristics, the performance qualities, and other pertinent data on the four different grades of oil furnace carbon blacks produced by the company. The grades discussed are: Philblack A, an FEF type of black; Philblack O, an HAF black; Philblack I, an ISAF black; and Philblack E, an SAF black.

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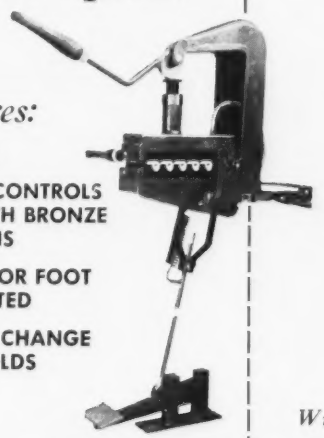

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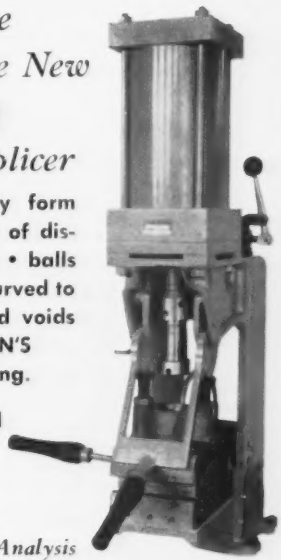

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MARKET REPORTS

TRENDS
NEWS
PRICES

Natural Rubber

The price of natural rubber on the New York Commodity Exchange moved in a range of 325 points since our last report (November 1), high for the period being 32.25c reached on November 2, and low being 29.00c reached on November 21 and 23. The average price of spot rubber in November was 30.63c based on 20 trading days. This compares with an average of 34.06c in October.

According to analysts at Merrill Lynch, Pierce, Fenner and Smith, as on previous occasions Singapore action becomes the focal point when the rubber market lacks economic news to act. Early in November a sharp break came when leading Chinese shippers became good sellers. This was taken as a cue that these sources had run out of means to continue their support program. Just as this thought had taken hold, one of these leading Chinese shippers announced that he would not let the price go below 87½ strait cents. Usually this is viewed as a cry for help, but it seems to have halted the decline for the time being.

Initially, prices broke through the announced support level, but they quickly rallied and have held steady. Some other factors also have to be given credit. Russia is presently loading about 20,000 tons of rubber. It is said that as much as 10,000 tons has been sold to London and the Continent. Considerable amounts of rubber are afloat to the United States, which will help improve the Singapore stock position.

Ceylon Re-enters

Also, Ceylon, which had re-entered the rubber market this year, may be out of it again if a barter deal with the United Arab Republic goes through. Just like the one with Red China, it would involve the exchange of rubber for rice and other commodities.

Ceylon has reduced its duty on exports of rubber by 8 Ceylon cents (.015c U.S.) a pound, from 38 Ceylon cents (.075c U.S.) to 30 Ceylon cents (.06c U.S.). The decision followed a steady price decline, with the lowest level in two years being reached in mid-November. Smaller rubber producers were planning to abandon rubber production temporarily in the face of the adverse price trend.

Malayan Efforts

Malaya, which appears to be moving into the position of the world's largest producer of natural rubber, is organizing its resources to fight off the competition of the latest synthetic products. An intensive re-planting scheme, research and development of new high-yielding trees, and stringent economy in plantation management are being used to safeguard the rubber industry, basis of the country's present prosperity.

NEW YORK, DECEMBER 1, 1960

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM NOV. 1 TO NOV. 30

Nov.	Spot	Jan.	Mar.	May	Sales
1	32.00	31.20	31.05	30.95	49
2	32.25	31.50	31.35	31.15	114
3	30.80	30.90	30.75	30.60	98
4	31.63	31.25	31.10	31.02	57
5	....	....	....	....	..
6	....	....	....	....	..
7	31.75	31.15	30.85	30.70	21
8	....	....	....	....	..
9	32.13	31.35	31.20	30.95	34
10	31.88	31.18	31.00	30.80	43
11	31.63	31.00	30.85	30.80	40
12	....	....	....	....	..
13	....	....	....	....	..
14	31.25	30.65	30.50	30.50	52
15	31.25	30.70	30.65	30.65	66
16	30.88	30.55	30.50	30.45	80
17	30.25	30.25	30.25	30.25	83
18	30.00	30.00	30.00	30.00	86
19	....	....	....	....	..
20	....	....	....	....	..
21	29.00	29.25	29.28	29.25	58
22	29.38	29.50	29.50	29.60	126
23	29.00	28.90	28.97	28.95	87
24	....	....	....	....	..
25	29.50	29.35	29.35	29.35	54
26	....	....	....	....	..
27	....	....	....	....	..
28	29.63	29.60	29.70	29.70	44
29	29.25	29.10	29.20	29.30	14
30	29.13	29.00	29.08	29.08	28

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.29⅛
Dec.	.29⅛
Jan.	.29⅛
Thin Latex Crepe:	
Spot	.31¼
Thin Brown Crepe, No. 2	.26¼
Flat Bark Crepe	.21¾

London Market

(Standard Smoked Sheets)

Jan.	29.57—29.86
Jan.-Mar.	29.72—29.86

Singapore Market

(Standard Smoked Sheets)

Jan.	28.56—28.64

Middling Upland Quotations

	Oct. 31	Nov. 30		
	Close	High	Low	Close
Dec.	31.50	31.38	31.32	31.38
Mar.	31.99	32.11	32.04	32.10
May	32.33	32.53	32.48	32.53

Notes & Quotes

American agility in bringing out new products affords this nation a continuing advantage in world-wide free business competition, H. E. Humphreys, Jr., board chairman of U. S. Rubber Co., stated recently. He explained that we have been drilled so long under the stern demands of highly competitive enterprise that it has become second nature for us to think ahead and always be ready to change our tack.

Synthetic Rubber

World synthetic rubber capacity will reach 3 million metric tons in 1961, stated Sydney T. Ellis, president of Petro-Tex Chemical Corp., in an address before the Societe de Chimie Industrielle, which met recently in Barcelona, Spain. He added that this is a far cry from five years ago, when the United States made practically all of the world's synthetic rubber. Mr. Ellis pointed out that synthetic rubber and supporting chemical plants are springing up all over the globe—new ones in Brazil, Argentina, Japan and Australia, and increased capacity for plants in France, Italy, England, West Germany, and in the Soviet bloc countries. In addition, there has been announced plans for new plants in Spain, Holland, and India, plus new plants and continued incremental expansion in the United States.

Mr. Ellis predicts a growth rate for synthetic rubber in the United States of about 5 per cent per annum. He believes that in all other countries the combined growth rate will be 8 per cent, and by 1965 world capacity is expected to be in excess of 4 million metric tons.

United States Situation

Mr. Ellis also discussed the United States synthetic rubber and butadiene situations. He projected that the annual capacity for SBR in this country at the end of 1961 will be 1.5 million metric tons. At present, he pointed out, synthetic rubbers account for about two-thirds of total United States consumption, of which butadiene-styrene rubber represents about 83 per cent, neoprene 8 per cent, butyl rubber 6 per cent, and nitrile rubber 3 per cent.

Exports Down

Exports of synthetic rubber from the United States to Europe appear to be heading downward as production in European Common Market plants increase faster than consumption. Figures obtained from the ECM statistical office in Brussels, Belgium, reveal that synthetic rubber production capacity in the six nations of the Common Market, which amounted to only 122,000 tons at the end of 1959, will be up to 395,000 tons by the end of 1961. According to the ECM, unless consumption rises above the 1959 level of 191,000 tons, the Common Market area should have a surplus for export.

The amount of synthetic rubber produced in the ECM countries during 1959 was 95,200 tons or 78 per cent of the capacity at the end of the year. It was more than double that of 1958 and over eight times that of 1957. Between 1951 and 1959, consumption of natural rubber rose by 28 per cent, while that of synthetic rubber was 1,000 per cent greater.

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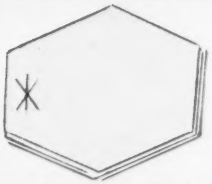

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Butaprene NH	.6500 [1]
Butaprene NL	.5000 [1]
Butaprene NXM	.5800 [1]
Chemigum N3NS and N5	.5800 [3]
Chemigum N6	.5000 [3]
Chemigum N6B	.5000 [3]
Chemigum N7	.5000 [3]
Chemigum N8	.5000 [3]
Chemigum N600	.5000 [3]
Herecol N-33	.6800 [3]
Hycar 1001 and 1041	.5800 [3]
Hycar 1002	.5000 [3]
Hycar 1014	.6000 [3]
Hycar 1042 and 1043	.5000 [3]
Hycar 1051	.5800 [3]
Hycar 1052	.5000 [3]
Hycar 1053	.5000 [3]
Hycar 1072	.6400 [3]
Hycar 1203	.4600 [3]
Hycar 1312	.5000 [3]
Hycar 1411	.6200 [3]
Hycar 1432	.5900 [3]
Hycar 1441	.6200 [3]
Paracril AJ	.4850 [3]
Paracril B and BJ	.5000 [3]
Paracril BLT and BJLT	.5000 [3]
Paracril C and CLT	.5800 [3]
Paracril CV	.6300 [3]
Paracril D	.6500 [3]
Paracril 18-80	.6000 [3]
Paracril OZO	.4600 [3]
Polysar Krynac 800	.5000 [3]
Polysar Krynac 801	.5800 [3]
Polysar Krynac 802	.5000 [3]
Polysar Krynac 803	.5000 [3]

Butadiene-Styrene Types

Ameripol 1000	.2410 [3]
Ameripol 1001	.2410 [3]
Ameripol 1002	.2435 [3]
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Ameripol 1009	.2475 [3]
Ameripol 1009 (crumb)	.2590 [3]
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Ameripol 1012	.2425 [3]
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Baytown 1811	.1569 [3]
Baytown 8675	.1820 [3]
Baytown 8676	.1876 [3]
Baytown 8677	.1820 [3]
Baytown 8678	.2080 [3]
Baytown 8679	.2022 [3]
Baytown 8680	.1775 [3]
Baytown 8681	.1835 [3]
Baytown 8775	.1545 [3]
Baytown 8776	.1679 [3]
Baytown 8777	.1550 [3]
Baytown 8778	.1480 [3]
Baytown 8779	.1496 [3]
Baytown 8780	.1507 [3]
Baytown 8781	.1655 [3]
Baytown 8782	.1583 [3]
Baytown 8783	.1515 [3]
C-102 (Shell)	.2300 [3]
Carbomix 3750	.1820 [3]
Carbomix 3751	.1545 [3]
Carbomix 3752	.1845 [3]
Carbomix 3753	.1640 [3]
Carbomix 3756	.1569 [3]
Carbomix 3757	.1480 [3]
Carbomix 3758	.1545 [3]
Carbomix 3760	.1496 [3]
CB-102 (Shell)	.1850 [3]
Copo 1006	.2410 [3]
Copo 1500	.2410 [3]
Copo 1502	.2410 [3]
Copo 1505-NS	.2610 [3]
Copo 1507	.2410 [3]
Copo 1712	.1885 [3]
Copo 1713	.1750 [3]
Copo 1714	.1725 [3]
Copo 1773	.2060 [3]
Copo 1778	.1910 [3]
Copo 2000	.2775 [3]
Copo 3700	.1725 [3]
Copo 3701	.1750 [3]
Copo 3900	.2310 [3]
FR-S 146	.2410 [3]
FR-S 158	.3000 [3]
FR-S 173	.2060 [3]
FR-S 178	.1910 [3]
FR-S 181 and 182	.2410 [3]
FR-S 184	.1885 [3]
FR-S 1000	.2410 [3]
FR-S 1001	.1410 [3]
FR-S 1004 and 1006	.2410 [3]
FR-S 1007	.2410 [3]
FR-S 1009	.2475 [3]
FR-S 1010	.2600 [3]
FR-S 1012	.2425 [3]
FR-S 1013	.2410 [3]
FR-S 1014	.2810 [3]
FR-S 1500 and 1502	.2410 [3]
FR-S 1703	.2060 [3]
FR-S 1710 and 1712	.1885 [3]
Gentro 1500	.2410 [3]
Gentro 1712	.1885 [3]
Gentro-Jet 9152	.2080 [3]
Gentro-Jet 9153	.1820 [3]
Gentro-Jet 9154	.1845 [3]
Gentro-Jet 9250	.1580 [3]
Gentro-Jet 9251	.1640 [3]
Gentro-Jet 9252	.1670 [3]
Gentro-Jet 9275	.1500 [3]
Naugapol 1016	.2650 [3]
Naugapol 1018	.2700 [3]
Naugapol 1019	.2650 [3]
Naugapol 1022	.2950 [3]
Naugapol 1023	.3150 [3]
Naugapol 1503	.2625 [3]
Naugapol 1504	.0330 [3]
Naugapol 6003	.2700 [3]
Naugapol 6100	.3100 [3]
OB-102 (Shell)	.1825 [3]
OB-104 (Shell)	.1475 [3]
OB-106 (Shell)	.1510 [3]
OB-110 (Shell)	.1410 [3]
OB-111 (Shell)	.1540 [3]
OB-113C (Shell)	.1750 [3]
OB-114C (Shell)	.1420 [3]
OB-116 (Shell)	.1810 [3]
Philprene 1000	.2410 [3]
Philprene 1006	.2410 [3]
Philprene 1009	.2475 [3]
Philprene 1018	.2700 [3]
Philprene 1019	.2650 [3]
Philprene 1500 and 1502	.2410 [3]
Philprene 1503	.2625 [3]
Philprene 1601	.1930 [3]
Philprene 1603	.1960 [3]
Philprene 1605	.1900 [3]
Philprene 1606	.1820 [3]
Philprene 1608	.1845 [3]
Philprene 1609	.2080 [3]
Philprene 1703	.2060 [3]
Philprene 1708	.1910 [3]
Philprene 1712	.1885 [3]
Philprene 1803	.1740 [3]
Philprene 1805	.1550 [3]
Philprene 1808	.1480 [3]
Plioflex 1006	.2410 [3]
Plioflex 1500C	.2410 [3]
Plioflex 1502	.2410 [3]
Plioflex 1507	.2410 [3]
Plioflex 1508	.2410 [3]
Plioflex 1510	.2410 [3]
Plioflex 1710C and 1712C	.1885 [3]
Plioflex 1713	.1750 [3]
Plioflex 1714C	.1725 [3]
Plioflex 1773	.2060 [3]
Plioflex 1778	.1910 [3]
Polysar Kryflex 200	.2510 [3]
Polysar Krylene	.2410 [3]
Polysar Krylene NS	.2410 [3]
Polysar Krynol 651	.1885 [3]
Polysar Krynol 652	.1910 [3]
Polysar S-630	.2410 [3]
Polysar S-X 371	.2550 [3]
Polysar SS-250	.2875 [3]
S-1000	.2300 [3]
S-1002	.2325 [3]
S-1006	.2300 [3]
S-1009	.2400 [3]
S-1011	.2325 [3]
S-1013	.2300 [3]
S-1500	.2300 [3]
S-1502	.2300 [3]
S-1509	.2300 [3]
S-1600	.1825 [3]
S-1602	.1825 [3]
S-1604	.1825 [3]
S-1605	.1800 [3]
S-1606	.1750 [3]
S-1607	.1750 [3]
S-1703	.1950 [3]
S-1707	.1800 [3]
S-1709	.1775 [3]
S-1710	.1775 [3]
S-1712	.1775 [3]
S-1778	.1800 [3]
S-1800	.1475 [3]
S-1802	.1410 [3]
S-1803	.1650 [3]
S-1804	.1750 [3]
S-1806	.1510 [3]
S-1807	.1540 [3]
S-1808	.1420 [3]
S-7652	.1875 [3]
S-7701	.1850 [3]
SP-103 (Shell)	.2900 [3]
Synpol 1000 and 1001	.2410 [3]
Synpol 1002	.2435 [3]
Synpol 1006	.2410 [3]
Synpol 1007	.2410 [3]
Synpol 1009	.2475 [3]
Synpol 1012	.2425 [3]
Synpol 1013	.2410 [3]
Synpol 1061	.2410 [3]
Synpol 1500	.2410 [3]
Synpol 1502	.2410 [3]
Synpol 1551	.2410 [3]
Synpol 1703	.2060 [3]
Synpol 1707	.1910 [3]
Synpol 1708	.1910 [3]
Synpol 1712	.1885 [3]
Synpol 8102	.2401 [3]
Synpol 8151	.1820 [3]
Synpol 8152	.1860 [3]
Synpol 8200	.1910 [3]
Synpol 8201	.1750 [3]
Synpol 8202	.1725 [3]
Synpol 8208	.1750 [3]
Synpol 8255	.1480 [3]
Synpol 8253	.1584 [3]
Synpol 8254	.1545 [3]
Synpol 8266	.1598 [3]
Synpol 8267	.1640 [3]

Butyl Rubbers

Enjay Butyl 035 and 150	.2300 [3]
Enjay Butyl 165 NS	.2400 [3]
Enjay Butyl 215	.2300 [3]
Enjay Butyl 217	.2300 [3]
Enjay Butyl 218	.2300 [3]
Enjay Butyl 268 NS	.2400 [3]
Enjay Butyl 325	.2300 [3]
Enjay Butyl 365 NS	.2400 [3]
Polysar Butyl 100	.2450 [3]
Polysar Butyl 101	.2775 [3]
Polysar Butyl 200 and 300	.2450 [3]
Polysar Butyl 301	.2550 [3]
Polysar Butyl 400	.2450 [3]

SYNTHETIC RUBBER POLYMERS

Chlorosulfonated Polyethylene

Hypalon 20	.4700 [2]
Hypalon 30	.6000 [2]
Hypalon 40	.5000 [2]

Fluoroelastomers

Kel-F Fluorel	$15.00 [3]
Kel-F 3700 and 5500	$16.00 [3]
Vitron A and A-HV	$10.00 [3]
Viton B	$13.00 [3]

Neoprene

	(prices f.o.b.)
Neoprene Types AC and CG	.5500 [3]
Neoprene Type AD	.5500 [3]
Neoprene Type FB	.6500 [3]
Neoprene Type GN	.4100 [3]
Neoprene Type GN-A	.4100 [3]
Neoprene Type GRT	.4200 [3]
Neoprene Type KNR	.7500 [3]
Neoprene Type S	.4200 [3]
Neoprene Type W	.3900 [3]
Neoprene Type WB	.4100 [3]
Neoprene Type WHV	.3900 [3]
Neoprene Type WRT	.4500 [3]
Neoprene Type WX	.4100 [3]

Polysulfide Rubbers

	(prices f.o.b.)
Thiokol Type A	.5000 [3]
Thiokol Type FA	.6900 [3]
Thiokol Type ST	1.2500 [3]

Silicone Rubbers*

	(prices f.o.b.)
GE (compounded)	2.50 [3]
GE Silicone Gum (not compounded)	4.00 [3]
Silastic (compounded)	2.56 [3]
Silastic (gums)	4.00 [3]
Union Carbide (gums)	4.00 [3]
Union Carbide (compounds)	2.50 [3]

Latex

(per pound carload)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400 and N-401	.5400 [1]
Chemigum 200	.4800 [2]
Chemigum 235	.5300 [2]
Chemigum 236	.5300 [2]
Chemigum 245	.4500 [2]
Chemigum 246	.4500 [2]
Chemigum 247	.4500 [2]
Chemigum 248	.4500 [2]
Hycar 1513	.4500 [2]
Hycar 1551	.5300 [2]
Hycar 1552	.4500 [2]
Hycar 1561	.5300 [2]
Hycar 1562	.4500 [2]
Hycar 1571	.5300 [2]
Hycar 1572	.4500 [2]
Hycar 1577	.4500 [2]
Nitrex 2612	.4500 [1]
Nitrex 2616	.5300 [1]
Nitrex 2620	.4500 [1]
Nitrex 2625	.4500 [1]
Tylac 640 and 650	.4500 [1]
Tylac 750	.4900 [1]
Tylac 850	.5300 [1]
Tylac 1640 and 1650	.5400 [1]

Butadiene-Styrene Types

CL-101 (Shell)	.2800 [2]
Copo 2000	.2775 [2]
Copo 2101	.3000 [2]
Copo 2102	.3200 [2]
Copo 2105	.3200 [2]
Copo 2108	.3000 [2]
Copo 2109	.2775 [2]
Copo 2110	.3200 [2]
Copo 3852	.3000 [2]
FR-S 110	.3000 [2]
FR-S 150	.3000 [2]
FR-S 151	.2900 [2]
FR-S 174	.2950 [2]
FR-S 176	.2775 [2]
FR-S 2000	.2775 [2]
FR-S 2001	.2775 [2]
FR-S 2002	.3000 [2]
FR-S 2003	.3050 [2]
FR-S 2004	.3050 [2]
FR-S 2006	.2900 [2]
FR-S 2105	.3200 [2]
Naugatex 2000 and 2001	.2750 [1]
Naugatex 2002	.3000 [1]
Naugatex 2006	.2900 [1]
Naugatex 2105 and 2107	.3200 [1]
Naugatex 2108	.3000 [1]
Naugatex 2113	.2900 [1]
Naugatex J-8174-F	.3200 [1]
Naugatex J-8855	.3000 [1]
Naugatex J-9049	.2750 [1]
Naugatex J-9064	.3050 [1]
Pliolite 2000	.2775 [2]
Pliolite 2001	.2775 [2]
Pliolite 2076	.2900 [2]
Pliolite 2104	.3200 [2]
Pliolite 2105	.3200 [2]
Pliolite 2107	.3200 [2]
Pliolite 2108	.3000 [2]
S-2000 and S-2006	.2600 [2]
S-2101	.2600 [2]
S-2105	.2800 [2]
S-2108	.2900 [2]
Tylac 400	.3000 [1]
Tylac 410 and 420	.2900 [1]
Tylac 450-A	.2750 [1]
Tylac 3040 and 3340	.3200 [1]

Neoprene

Neoprene Latex 60	.4000 [2]
Neoprene Latex 571	.3700 [2]
Neoprene Latex 572	.3900 [2]
Neoprene Latex 601-A	.4000 [2]
Neoprene Latex 673	.5000 [2]
Neoprene Latex 735	.3800 [2]
Neoprene Latex 736	.3800 [2]
Neoprene Latex 842-A	.3700 [2]
Neoprene Latex 950	.4700 [2]

Polysulfide Rubbers

Thiokol Type MX	.8000 [3]
Thiokol Type WD-2	1.2500 [3]
Thiokol Type WD-6	.8000 [3]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

Suppliers are your Materials Listed in the Market Prices Section?
If not, forward full information to —
Market Editor

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MARKETS

(continued)

Reclaimed Rubber

The reclaimed rubber segment continues its steady if unspectacular pace as the year draws to a close. It now seems as if 1960 production and consumption will parallel figures set in 1959 when 303,000 long tons were produced and 286,000 long tons of reclaim were consumed.

Industry oracles are a little loathe to predict any significant "ups" or "downs" for 1961, but from all indications, 1961 should be equal if not better than 1960 in all respects.

Indications as to substantial price movements, either up or down, are lacking. The market assumption is that the reclaimed rubber market will maintain just about the present pace, at least through the first quarter of the new year. Current quotations follow:

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11½
First Line Whole Tire	.11
Second Line Whole Tire	.10½
Third Line Whole Tire	.10¼
Fourth Line Whole Tire	.09¾
Black Carcass	.15¼
No. 1 Light Colored Carcass	.22
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.16
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

In the closing month of 1960, the scrap rubber market continues in its characteristic manner — lackadaisical. Prices in the past few weeks have been generally steady. Reclaimers have not been pressing for supplies and have, apparently, been content to work off inventories.

There is some hesitancy in predicting what the new year may hold. It is generally expected that at the very least, 1961 will be no worse than 1960 and there are some indications that the new year may even be a little better. At the moment, however, there is nothing dramatic in the air, nothing to suggest either a sparkling upward or downward trend in the months that lie ahead. Current quotations follow:

(Prices Delivered Akron)

Mixed tires	ton	15.00
Light colored carcass	lb.	.05½
No. 1 peelings	ton	45.00
No. 2 peelings	ton	28.00
No. 3 peelings	ton	23.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	22.00
Passenger S.A.G.	ton	20.00
Natural Rubber Red Tubes	lb.	.07½
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.08¾

Tire Fabrics

Plans calling for a 70 per cent increase in its heavy denier nylon production capacity were announced recently by American Enka Corp., New York, N. Y. The expansion project is said to be the largest single expansion undertaken by the firm at its Enka, N. C., location since the original rayon plant was built there in 1928.

Exact cost of the project was not revealed, however reports indicate that the program would represent a multimillion dollar investment by American Enka. Construction is underway, with start-up production anticipated within 15 months and full commercial production in 18 months.

Until several months ago, American Enka's production of nylon was limited to fine denier yarns for the textile trade. Last August, a new unit was completed for the production of heavy denier yarns for tires, as well as industrial uses, carpets, and other home furnishings. A second unit, which is expected to bring the capacity of heavy denier yarns to more than 6 million pounds annually, is now under construction, and completion is anticipated in the Spring of 1961.

According to American Enka, increased output of nylon tire yarn will enable it to supply tire manufacturers with either nylon or Tyrex rayon tire yarns. The firm is said to be one of the country's largest producers of Tyrex yarn, and the second largest producer of rayon. American Enka entered the nylon field in 1954, and its nylon operations have been in an almost continuous state of expansion since that time.

Sells Nylon Plant

Industrial Rayon Corp., Cleveland, Ohio, has sold its Covington, Va., Nylon plant to Hercules Powder Co., Wilmington, Del. The move puts Industrial Rayon out of nylon manufacturing and was made as part of a regrouping of facilities in an effort to eliminate losses, the company states. Hercules reports that it will convert the nylon plant to the production of polypropylene fibers, with an estimated annual capacity in excess of 10 million pounds of polypropylene staple fiber and continuous multifilament yarns.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.62½
1650	lb.	.62
2200	lb.	.62½

Nylon Tire Cord

210	lb.	1.75
840	lb.	1.47

Rayon Graded Fabric

1100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.71
9.25 oz. (per square yard)	lb.	.72
11.65 oz. (per square yard)	lb.	.66
14.4 oz. (per square yard)	lb.	.75

Liquid Latex

Natural: As the year draws to a close, those persons involved with natural rubber latex face a new year which may be most significant to the future of the commodity. This past year has seen significant decreases in the quantities of natural latex imported into this country and in the volume consumed by the industry.

Much of the decline has been attributed to the relatively high prices which have existed during the year. At the moment, natural latex is selling at about a 36-37c level in car load lots at East Coast ports. Within the past few months, latex prices have come down to a considerable degree. If this trend were to continue into 1961, natural latex may resume a higher consumption level.

If, however, prices continue to rise, natural latex may have difficulty in holding what market it now has. It has been stated previously that buying "habits" may be difficult to break. Once consumers get the synthetic habit, the trend will be hard to break.

Synthetic: All during 1960 synthetic latices have been showing increases in both production and consumption. At this point, there is no reason to believe that the synthetic segment will not hold this pace, at least for the first quarter of 1961. Synthetic producers have every reason to look to 1961 with every confidence, many in the trade believe.

Cotton

The price of middling uplands on the New York Cotton Exchange moved in a range of ten points since our last report (November 1), high for the period being 32.30c reached on November 18 through 30, and low being 32.20c reached on November 4 and 7. The average price of middling uplands for November was 32.27c based on 20 trading days. This compares with an average of 32.21c in October.

There are reports that tentative plans have been made for the first meeting of President-elect Kennedy's Cotton Advisory Committee with the new Secretary of Agriculture on December 18 and 19 in either Memphis, Tenn., or New Orleans, La. Various sources feel that President-elect Kennedy's concept of "parity income" for farmers does not mean setting support prices at such high levels as to make the crop uncompetitive pricewise. What is envisioned is a reasonable support level supplemented by a direct payment program.

The Joint Economic Committee reports that junking of all Government farm price supports and production controls would result in cotton prices, averaging about 32c a pound in 1959, to skid to 21c—about 34 per cent by 1965.

The report did not suggest elimination of all government price supports and other farm stabilization schemes, but cited what would happen to basic commodities if such a plan were followed.

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MARKET PRICES

CHEMICALS & COMPOUNDING INGREDIENTS

DECEMBER 1, 1960

Prices are, in general, f.o.b. works and cover the domestic markets only. Export prices, as a rule, are usually slightly higher, due to packing regulations, special handling, etc.

Abbreviations: bbls., barrels; c.l., carload; cyl., cylinder; dlvd., delivered; dms., drums; eqld., equalized; l.c.l., less than carload; M.B. masterbatch; min., minimum; ref., refined; sap., saponified; sp., special; syn., synthetic; t.c., tank cars.

*Trademark. †For Export Only.

The arrangement of this section closely follows the Chemical Section of the 1961 RUBBER RED BOOK. Readers are referred to that edition for the correct classification of any material or brand name. Suppliers of every material are contacted for price information. However, only those materials are listed for which quotations have been furnished within the past six months. The quotations are not guaranteed and prospective purchasers should contact suppliers for information. Suppliers are requested to send current price information to the Market Editor, RUBBER AGE.

ACCELERATORS

A-1 (Thiocarbanilide)*	lb.	.74	.81
A-32*	lb.	.66	.80
A-100*	lb.	.52	.66
Accelerator No. 8*	lb.	—	1.25
Accelerator*-49*	lb.	.60	.61
Accelerator 108*	lb.	—	.92
Accelerator—552*	lb.	—	2.25
Accelerator—808*	lb.	.66	.68
Accelerator—833*	lb.	1.17	1.19
Accelerator B*	lb.	—	.92
Altax*	lb.	.54	.56
Amax*	lb.	.75	.77
No. 1*	lb.	.71	.73
Ancap*(†)	lb.	.38	.40
Ancatax*(†)	lb.	.48	.50
Ancazate BU (ET & ME)*(†)	lb.	—	1.07
Ancazide ET*(†)	lb.	—	1.07
ME*(†)	lb.	—	1.14
Arazate*	lb.	—	2.25
Arquad 12*	lb.	.55	.61
Beutene*	lb.	.66	.68
Bismate, Rodform*	lb.	—	3.00
Butazate 50D*	lb.	.87	.89
Butyl Eight*	lb.	1.10	1.35
Butyl Namate	lb.	.45	.50
Captax*	lb.	.44	.46
C-P-B*	lb.	—	1.95
Cumate, Rodform*	lb.	—	1.45
Cydac*	lb.	.71	.73
Delac S*	lb.	.71	.73
DIBS*	lb.	—	.85
Diorthotolyguanidine	lb.	.69	.70
Dipac*	lb.	—	.85
Diphenylguanidine	lb.	.51	.52
Dithiocarbamates			
Cyzate B & E	lb.	.85	.89
El-Sixty*	lb.	.62	.69
Ethazate*	lb.	—	1.04
50D*	lb.	.87	.89
Ethyl Thiurad*	lb.	—	1.04
Ethyl Tuex*	lb.	—	1.04
Ethylac*	lb.	.93	.95
Geigy Amines	lb.	.46	.52
Guantal*	lb.	.62	.69
Hepteen Base*	lb.	—	1.85
Kure-Blend MT*	lb.	—	.70
Ledate, Rodform*	lb.	—	1.04
MBT-XXX*	lb.	.55	.57
MBTS Grains*	lb.	.54	.56
Merac*	lb.	.75	1.05
Mercaptobenzothiazol	lb.	.44	.46
Mercaptobenzothiazyl Disulfide	lb.	.54	.56
Mertax*	lb.	.55	.62
Methazate*	lb.	—	1.04
Monex*	lb.	—	1.14
Mono Thiurad*	lb.	—	1.14
2-MT	lb.	.88	.90
NA-22* (for neoprene)	lb.	—	1.05
NOBS No. 1*	lb.	.71	.73
Special*	lb.	.75	.77
O-X-A-F	lb.	.55	.57
Pennac SDB*	lb.	.45	.48
Pentex*	lb.	—	1.24
Flour*	lb.	—	.30
Permalux (Neoprene)*	lb.	—	2.25
Phenex*	lb.	.60	.65
Polyac*	lb.	—	1.85
R-2 Crystals*	lb.	—	4.35
Rotax*	lb.	.55	.57
RZ-50-A* and B*	lb.	.70	1.00
Santocure*	lb.	.71	.73
NS*	lb.	.71	.73
26*	lb.	.75	.77
Selenac* (Ethyl, Methyl)	lb.	—	3.00
Seleram, Ethyl	lb.	—	3.00
Setsit-5*	lb.	.75	1.05
9*	lb.	.85	1.15
SPDX-GH*	lb.	.77	.79
GL*	lb.	1.20	1.30
Tellurac*	lb.	—	1.55
Tepidone*	lb.	.45	.45
Tetrone A*	lb.	—	1.98
Thiate A*	lb.	.88	—
B*	lb.	1.05	1.25
Thiazole ZMBT	lb.	.55	.57
Thiofide*	lb.	.54	.61
Thionex*	lb.	—	1.14
Thiotax*	lb.	.44	.51
Thiram, Ethyl Methyl	lb.	—	1.04
Thiurad*	lb.	—	1.14
Thiuram E*	lb.	—	1.14
M*	lb.	—	1.04
Cyuram DS & MS	lb.	—	1.14
Trimene*	lb.	1.14	1.14
Base*	lb.	.56	.58
Triphenyl Guanidine	lb.	1.03	1.06
Tuads* (Ethyl)	lb.	—	.90
Tuads* (Methyl)	lb.	—	1.04
Tuex*	lb.	—	1.14
Ultex*	lb.	—	1.14
Unads*	lb.	1.15	1.20
Vulcacure NB*	lb.	—	1.14
NS*	lb.	.45	.45
TMD*	lb.	.75	1.05
ZB*, ZE*, ZM*	lb.	—	1.14
Z-B-X*	lb.	.85	.89
Zenite*	lb.	—	2.45
Zenite A*	lb.	.54	.56
Zenite AM*	lb.	.69	.71
Zenite Special*	lb.	.76	.78
Zetax* (uncoated)	lb.	.55	.57
Zimate* (Butyl)	lb.	.55	.57
Zimate* (Ethyl)	lb.	—	1.04
Zimate* (Methyl)	lb.	—	1.04
Zimate Slurry 50% solids content (Butyl, Ethyl & Methyl)	lb.	—	1.04
Ziram, Butyl	lb.	.85	.89
50% Dispersion	lb.	—	1.04
Ziram, Ethyl	lb.	.85	.89
50% Dispersion	lb.	—	1.04
Ziram, Methyl	lb.	.85	.89
50% Dispersion	lb.	.85	.89

ACTIVATORS

Blue Lead Sublimed	lb.	.17	.18
Cottonseed Fatty Acids			
Drew Wecoline C*	lb.	.17¾	.19
Wochem 210* and 211*	lb.	.14¾	.17½
Fish Oil, Hydrogenated, Fatty Acid			
Century Hydrex 440	lb.	.11½	.14
DAR S*	lb.	.10	.12½
DAR-HY	lb.	.14¾	.16¾
Groco 56*	lb.	.09	.11½
Hydrofol Acids*	lb.	.09	.20½
Hyfac 430*	lb.	.17	.19½
Neo-Fat H.F.O.*	lb.	.14½	.15¾
Neutrex*	lb.	.13¾	.16¼
Stearite*	lb.	.11¾	.14¼
Talene*	lb.	.16¼	.18¾
Wecoline 200*	lb.	.14¾	.16
1000*, 1500*	lb.	.12	.13¼
Wechem 730*	lb.	.10	.12½
731*	lb.	.14¼	.16¾
732*	lb.	.15¼	.18¾
Lime, Hydrated			
Arrowhead*	ton	—	21.00
Marblehead*	ton	—	19.25
Sierra*	ton	—	22.50
Litharge			
Eagle-Picher* (c.l.)	lb.	.13¾	—
National Lead*	lb.	—	.13¾
SB*	lb.	—	.18½

ACTIVATORS (Cont'd)

Magnesium Oxide, Heavy			
DCI 601*	lb.	.25¼	—
General Magnesite 500*	lb.	.05½	.06
600*	lb.	.06½	.07
Kaiser 325*	lb.	.03½	.06¼
Michigan No. 15*	lb.	.05½	.06½
Morton's Magnesia	lb.	.25¼	—
Magnesium Oxide, Light			
Carey Mag*	lb.	.25¼	.26
DCI Technical*	lb.	.21½	.23½
General Magnesite* (neoprene grade)	lb.	.26¾	.28¾
General Magnesite No. 101*	lb.	.24¾	.27¼
Genmeg MLW*	lb.	.25¾	.27¾
Light Calcined Magnesia			
No. X-01*	lb.	.25¼	.26
Maglite D*	lb.	.25¼	—
K*	lb.	.25¾	.27
L*	lb.	.29¾	.30¾
M*	lb.	.27	.28½
Seamag*	lb.	.20	.20½
Marmag*	lb.	.24¾	.26
Michigan No. 30*	lb.	.24¼	.26½
Michigan 1782 Magnesia*	lb.	.25¼	.26½
Neomag Powder*	lb.	.29¼	.30
Pellets*	lb.	.31¼	.32
Oleic Acid			
Dar-Chem* 105	lb.	.16	.18½
Drew Wecoline OO*	lb.	.17¼	.19
Emersol 210*	lb.	.16	.18½
Groco Red Oil	lb.	.16	.18½
Neo-Fat 92-04*	lb.	.20½	.22½
94-04*	lb.	.18½	.20½
Wochem 310, 311	lb.	.16	.18½
Palm Fatty Acids			
Groco 45*	lb.	.14¾	.17¼
Neo-Fat*	lb.	.15¾	.17¾
Wochem 280*	lb.	.15	.17½
281*	lb.	.15½	.18
Potassium Oleate (dms.)	lb.	.48	.73
Drew 24%*	lb.	.20	.73
Red Lead			
Eagle-Picher* (c.l.)	lb.	.14¼	—
National Lead*	lb.	.14¼	.14¾
No. 2 RM*	lb.	—	.18½
Sodium Laurate, 75%	lb.	.64	.89
Sodium Oleate, 75%	lb.	.54	.79
Paste (dms.)	lb.	.39	.64
Sodium Stearate, 75%	lb.	.47	.72
Stearic Acid, Single Pressed			
Century 1210*	lb.	.15¼	.17¾
Dar-Chem 11*	lb.	.14¾	.17¼
Emersol 110*	lb.	.14¾	.17¼
Neo-Fat 18-53*	lb.	.14¾	.16¾
Stearic Acid, Double Pressed			
Century 1220*	lb.	.15¾	.18¼
Dar-Chem 12*	lb.	.15¼	.17¾
Emersol 120*	lb.	.15¼	.17¾
Groco 54*	lb.	.15¼	.17¾
Neo-Fat 18-54*	lb.	.15¼	.17¼
Stearic Acid, Other			
Century 1230*	lb.	.17½	.20
1240-Supra*	lb.	.17½	.20
Extra Pearlstearic*	lb.	.17½	.20
Neo-Fat 18*	lb.	.18½	.20½
18-58*	lb.	.14¼	.16¼
18-61*	lb.	.16¼	.18¼
Stearex*	lb.	.11¾	.13
Stearite*	lb.	.11¼	.13¼
Wecoline 300*	lb.	.15¼	.16½
Wochem 720*	lb.	.10¼	.12¾
721*	lb.	.10¼	.12¾
White Lead Basic Carbonate	lb.	.18	.19
White Lead Basic Sulfate	lb.	.17	.18
Zinc Laurate			
Laurex*	lb.	.37	.39
Zinc Stearate	lb.	.41	.46
Aquazinc K.C.*	lb.	.30	.55
Crown Brand*	lb.	.39	.44

Unclassified Activators

Aktone*	lb.	.21¼	.23¼
barak*	lb.	—	.65
Curade*	lb.	.57	.59
DCI Magnesium Carbonate*	lb.	.11	—
Dibenzo G-M-F	lb.	—	2.60
D-B-A*	lb.	—	1.95
G-M-F*	lb.	—	2.60
Dibutylamine (dlvd.)	lb.	.55½	.56½
MODX*	lb.	.38	.40
Neo Fat 42-07*	lb.	.10¼	.12¼
Ridacto* (dms.)	lb.	.25	.26
Snodotte* (dlvd.)	lb.	.18½	.21
Vimbra	lb.	.32	.38½
Vulklor*	lb.	.88	.98

ANTI-COAGULANTS

Aqua Ammonia* (dms.)	lb.	.031	.035
M.B.M.C.* (l.c.l.)	lb.	.54	.76

ANTI-FOAMING AGENTS

Aero Anti Foam H*	lb.	—	.20
Regular*	lb.	—	.12
Anhydrol 6991*	lb.	.51	.56
D.C. Antifoam A*	lb.	4.85	5.95
Antifoam A Emulsion*	lb.	1.78	2.58
Antifoam AF Emulsion*	lb.	1.78	2.58
Antifoam B*	lb.	.59	1.06
Defoama W-1701*	lb.	—	.14½
Defoamer A-25*	lb.	—	3.00
Defoamer 630*	lb.	—	.14
Deltyl Prime	lb.	.70	.80
Foamnix*	lb.	.60	1.50
G-E Antifoam SS-24*; 66*	lb.	5.28	6.65
60 Emulsion*	lb.	2.05	3.75
Igepol CO-210	lb.	—	.36
Kessco X-3* (dms.)	lb.	—	.39
X-180*	lb.	—	.28
X-181*	lb.	—	.36½
Nopco 1407*	lb.	.20½	.22½
1497-V*	lb.	.15¼	.17¼
1907-B*	lb.	.22½	.25
JMK*	lb.	.48½	.51
JMU*	lb.	.23¼	.25¾
JMY*	lb.	.23¼	.23½
NDW*	lb.	.21½	.24
Pluronic L61*	lb.	.33½	.39
RS-968*	lb.	.38	.38½
Terpinol Prime No. 1	lb.	.35	.50
Tributyl Phosphate (dms.)	lb.	.52½	.53½
UC SAG 47*	lb.	4.85	6.25
470*	lb.	.61	1.10
VL-520*	lb.	2.68	3.50

ANTIOXIDANTS

Agebest 1293-22A*	lb.	1.90	2.00
AgeRite Alba*	lb.	2.40	2.50
Gel*	lb.	.70	.72
Hipar*	lb.	1.05	1.07
H.P.*	lb.	.79	.81
Powder*	lb.	.57	.59
Resin*	lb.	.88	.90
Resin D*	lb.	.57	.59
Spar*	lb.	.57	.59
Stalite & Stalite S*	lb.	.57	.59
Superflex*	lb.	.57	.59
Superlite*	lb.	.57	.59
White*	lb.	1.50	1.60
Akroflex C* Pellets	lb.	.85	.87
CD*	lb.	.79	.81
Aminox*	lb.	.57	.59
Antioxidant 425*	lb.	2.47	2.50
Antioxidant 2246*	lb.	1.50	1.53
Antox*	lb.	.59	.61
Aranox*	lb.	—	3.25
Benzoquinone	lb.	1.50	1.75
Betanox Special*	lb.	.94	.96
B-L-E*	lb.	.57	.59
Catalin CAO No. 1*	lb.	.57	.60
CAO No. 3*	lb.	.65	.68
CAO No. 5*	lb.	1.49	1.50
CAO No. 6*	lb.	—	3.50
Dalpac 4	lb.	.57	.60
Deenax*	lb.	.57	.60
Diphenylamine	lb.	.31	.33
Di-tert-Butyl-para-Cresol*	lb.	.86	1.16
DBPC*	lb.	.54	.60
Eugenol C-95%*	lb.	2.30	2.50
Flectol H*	lb.	.57	.64
Flexamine*	lb.	.79	.81
Ionol*	lb.	.57	.60
Naugawhite*	lb.	.57	.59
Powder*	lb.	.57	.59
Neozone A*	lb.	.64	.66
C*	lb.	.86	.88
D*	lb.	.57	.59
Nevastain A*	lb.	.51	.61
B*	lb.	.51	.70
Nullapon BF-12*	lb.	—	.21½
BF-13*	lb.	—	.25½
BF-78*	lb.	—	.55
BF-Acid*	lb.	—	.85
Octamine*	lb.	.57	.59
Oxidex*	lb.	—	3.60
PDA-10*	lb.	.46	.48
Pennox* A, B, C, D	lb.	.57	.72
Permalux*	lb.	—	2.25
Polygard*	lb.	.57	.59
Santoflex AW*	lb.	.71	.78
DD*	lb.	.57	.64
75*	lb.	1.01	1.08
Santovar-A*	lb.	1.55	1.62
Santowhite Crystals*	lb.	1.55	1.62
Santowhite L*	lb.	.57	.64
MK*	lb.	1.25	1.32
Powder*	lb.	1.55	1.62
Sequestrene AA*	lb.	.70	.80
NA2*	lb.	.59	.66
NA3T*	lb.	.54	.61
Sodium Nitrate	cwt.	8.75	11.00
Stabilite*	lb.	.57	.59
Alba*	lb.	.75	.80
FLX*	lb.	.78	.80
L*	lb.	.65	.67
White*	lb.	.57	.59
White Powder*	lb.	.46	.48
Stabilizer No. 1*	lb.	1.55	1.80
Stabilizer No. 9 A*	lb.	.80	1.05
Styphen I*	lb.	.51	.55
Sunolite*	lb.	.16	.22
Tecquinol*	lb.	.82½	.84½
Tannic Acid, Tech	lb.	.46	.48
Tenamene 3*	lb.	.57	.60
Thermoflex A*	lb.	1.05	1.07
Wing-Stay S*, T*	lb.	.56	.67
Zalba*	lb.	—	1.10
Special*	lb.	—	.85

ANTIOZONANTS

Eastozone* 32*	lb.	1.15	1.18
Flexzone 3C	lb.	—	2.00
6-H	lb.	1.25	1.27
Fura-Tone NC-1008*	lb.	.28	.39
NC-1012*	lb.	.46	.69
Santoflex AW*	lb.	.71	.78
UOP 88* & 288* (dms.)	lb.	1.05	1.07
Wing-Stay 100*	lb.	1.00	1.08

ANTI-SCORCHING AGENTS

Akron Benzoic Acid	lb.	.41	.43
Armeen HT*	lb.	.34	.40
Good-rite Vultrol*	lb.	.67	.70
Harcopol 1183*	lb.	.70	.74
Retarder PD*	lb.	.37	.39
W*	lb.	—	.46
Sodium Acetate 60-62% Crystals	lb.	.08	.08½

ANTISEPTICS AND GERMICIDES

A.P.C. 6901*	lb.	.32	.38
Arquad S*	lb.	.38	.44
Formaldehyde (dms.)	lb.	.06	.076
G-4* (bbls.)	lb.	1.09	1.29
G-11*	lb.	1.98	2.08
Halane*	lb.	.40	.47
Irgason BS200*	lb.	2.50	2.75
Ortho Cresol (26°—27°)	lb.	.15	.16
Preventol GD	lb.	—	1.09
Retarder D*	lb.	.42	.50

ANTI-WEBBING AGENTS (for Latex)

DC 7 Compound*	lb.	4.70	5.80
Webmix 34-L*	lb.	1.25	1.75
57*; 69C*	lb.	1.50	2.00
71*	lb.	1.25	1.75

AROMATICS (DEODORANTS)

Airkem 115*	gal.	—	6.50
122*; 186*	gal.	—	6.50
Alamask AA*	lb.	—	3.00
AF*	lb.	—	2.50
AO*	lb.	—	1.50
AR*	lb.	—	.50
BG*	lb.	—	1.15
BGM*	lb.	—	.60
CY*	lb.	—	2.40
DJ*	lb.	—	3.35
DL*	lb.	—	1.95
H*	lb.	—	5.50
LD*	lb.	—	.75
ND*	lb.	—	2.75
O*	lb.	—	6.50
OS*	lb.	—	5.25
Bouquet 149*	lb.	—	3.00
Coumarin*	lb.	—	3.70
Deodorant 65*	lb.	—	1.85
Deodorant L-37*	lb.	2.15	2.25
L-44*	lb.	2.65	2.75
N.L.T.X.*	lb.	1.90	2.00
Deodorant Oil GD 6422*	lb.	1.90	2.20
GD 6423*	lb.	1.60	1.90
GD 6575*	lb.	2.40	2.90
GD 31063*	lb.	2.25	2.75
Ethavan*	lb.	6.20	6.25
Latex Perfume 17326	lb.	—	4.00
18301	lb.	—	3.00
22258	lb.	—	2.50
Naugaromes* (dms.)	lb.	.60	3.00
Neutroleum Delta*	lb.	—	2.25
Gamma*	lb.	—	3.25
Parador A*	lb.	1.80	2.10
C*	lb.	2.00	2.50
E*	lb.	.25	.40
GD 5280*	lb.	2.00	2.50
GD 53481*	lb.	1.70	2.00
Perfume Oil Bouquet Vanilla M*	lb.	1.60	1.70
Rodo No. 0*	lb.	4.00	4.50
No. 10*	lb.	5.00	5.50
Rubbarome* (dms.)	lb.	.60	3.80
Rubber Perfume 12*	lb.	—	4.35
Russian Leather 7*	lb.	—	4.35
Vanillin	lb.	2.75	2.80

BLOWING AGENTS

Ammonium Bicarbonate	cwt.	—	9.00
Better Blend Soda* (c.l., bags)	cwt.	—	2.70
B-I-K	lb.	.20	.22
Blowing Agent No. 81105	lb.	.32	.35
Celogen*	lb.	—	1.95
AZ*	lb.	1.92	1.94
80	lb.	—	1.60
Diazo Amino Benzene	lb.	—	.73
Kempore R-125	lb.	—	1.92
Neo Fat 42-12*	lb.	.10¼	.12¼
Opex 40	lb.	—	.72
Sodium Bicarbonate, U.S.P. (c.l., bags)	cwt.	—	2.55
Unicel ND*	lb.	—	.72
S*	lb.	—	.20
Urea	lb.	.06	.07

BONDING AGENTS

Base 6986*	lb.	.27	.32
Braze*	gal.	6.00	9.00
Braze Cover Cement*	gal.	2.50	4.00
Chemlock 201, 203	gal.	5.00	7.50
220	gal.	8.95	12.00
401	gal.	5.00	24.00
607	gal.	18.00	24.00
614	lb.	4.35	4.75

BONDING AGENTS (Cont'd)

Durez 12987*	lb.	.47½	.49
EX-B5501-4	gal.	6.20	4.90
EX-B150-1	gal.	8.15	11.00
EX-B579-1	gal.	19.40	26.40
Gen-Tac Latex*	lb.	.70	.75
Hylene M*	lb.	1.25	1.50
M-50*	lb.	.86	1.11
Penacolite B1A*	lb.	—	.95
R-2710*	lb.	—	.95
Phobond 20*	gal.	2.91	4.23
30*	gal.	3.65	4.97
Rex Compounds*	gal.	1.30	1.90
Thixons*	gal.	2.95	9.80
Ty-Ply Q (BN & S)*	gal.	6.75	8.00
Tygobond 30*	gal.	4.10	5.40
40*	gal.	5.80	6.89
41*	gal.	8.65	9.85
45*	gal.	5.75	6.48
Vinculux	gal.	—	4.95

COAGULANTS

Acetic Acid—56% (bbls., cwt		9.00	11.00
Glacial 99½% (dms.)	lb.	.12	.13
Calcium Nitrate, Tech. Flake	lb.	.07½	.09½
Hydroxyacetic Acid—70% (dms.)	lb.	—	.09½
Zinc Nitrate, Tech. Flake	lb.	—	.20

COLORING AGENTS

Black

Aquablak B*	lb.	.09¾	.10¾
M*	lb.	.10½	.11
S*	lb.	.11¾	.12¼
Black Shield 4*	lb.	.10	.10½
No. 6	lb.	.11	.11½
No. 17	lb.	.12½	.13
No. 19	lb.	.12	.12½
Carbon Black—See *Reinforcing Agents*			
Lampblack No. 10*	lb.	.06	.09
Mapico Black Iron Oxide* (50 lb. bags)	lb.	.14¾	.15
Pure Black Iron Oxide	lb.	.14¾	.15

Blue

Akron Masterbatches*	lb.	2.23	2.78
Toners*	lb.	2.30	6.35
Blue Powders	lb.	2.20	3.75
Cooke M.B. Blue* 426	lb.	2.20	3.75
Cyan Blue GT 55-3295	lb.	—	3.20
XR 55-3760	lb.	—	2.90
XR 55-3770	lb.	—	3.25
Disco Blues	lb.	2.20	3.45
Harmon Blue Toner B-4776	lb.	—	2.90
Monastral Rubber Blue CPL*	lb.	1.95	1.95
PCD, Dispersed*	lb.	—	2.55
Peacoline Blue*	lb.	—	3.85
Ramapo Blue*	lb.	2.75	3.00
Rubber Blue GD* (Disp.)	lb.	—	4.75
Rubber Blue X-1999*	lb.	—	1.90
Rubber Dispersed Blues	lb.	2.52	2.78
Solfast Blue*	lb.	1.60	3.25
Stan-Tone MBS*	lb.	2.20	2.92
GPE*	lb.	2.25	2.75
PEC*	lb.	1.95	2.10
Ultramarine	lb.	.14	.30
Vansul Blue M.B.*	lb.	1.00	2.70

Brown

Brown Iron Oxide	lb.	.15¾	.16
Mapico Brown* (50 lb. bags)	lb.	.15¾	.16
Stan-Tone GPE*	lb.	—	3.00
Vansul Brown M.B.* (Organic)	lb.	—	2.30

Green

Akron Masterbatches*	lb.	1.53	3.08
Toners*	lb.	1.50	4.35
Chromium Oxide	lb.	.44½	.45¼
Cooke M.B. Green*	lb.	1.60	2.80
413*	lb.	—	2.80
Cyan Green 15-3100	lb.	—	3.35
Disco Greens	lb.	1.55	2.80
Green Powders	lb.	1.35	3.95
Harmon Green Toner G-5056	lb.	—	3.95
Hi-Fiz Fluorescent	lb.	1.60	2.60
Monastral Rubber Green GSD* (Dispersed)	lb.	—	2.80
GSL*	lb.	2.20	2.20
Permansa Green CP-1236*	lb.	—	1.45
Pigment Green B*	lb.	1.45	1.50
GL-632D*	lb.	.90	.95
Ramapo Green*	lb.	—	3.50
Rubber Dispersed Greens	lb.	1.23	3.08
Rubber Green FD* (Disp.)	lb.	—	2.05
Rubber Green X-1292*	lb.	—	1.75
Serene Green*	lb.	—	3.50
Solfast Green*	lb.	1.60	3.35
Stan-Tone MBS*	lb.	2.50	3.42
GPE*	lb.	1.50	1.70
PC*	lb.	2.20	2.25
Vansul Green M.B.*	lb.	1.50	2.75

Maroon

Akron Masterbatches*	lb.	3.53	4.38
Toners*	lb.	.98	5.60
Harmon Maroon Toner MV-6606	lb.	—	5.75
Pyrolux Maroon*	lb.	—	3.40
Vansul Maroon M.B.*	lb.	—	4.05

COLORING AGENTS (Cont'd)

Orange

Akron Masterbatches*	lb.	2.53	2.98
Toners*	lb.	2.97	4.30
Benzidene Orange	lb.	—	3.30
Cooke MB*	lb.	2.25	2.35
425*	lb.	—	2.25
Dianisidine Orange*	lb.	—	2.85
Disco Oranges	lb.	2.30	2.85
Harmon Diane Orange Toner Y-25	lb.	—	2.85
Pyrazolone Orange Toner YB-3	lb.	—	3.30
Hi-Fiz Fluorescent	lb.	1.40	2.40
Mercadium X-2667*	lb.	—	1.65
Molybdate Orange	lb.	—	.49
Oswego Orange X-2065*	lb.	—	3.30
Rubber Orange OD* (Disp.)	lb.	—	2.25
Stan-Tone Cadmium Dry*	lb.	1.85	4.28
Cadmium Paste*	lb.	2.43	2.85
GPE*	lb.	1.05	1.20
PC*	lb.	.75	.80
Vansul Orange M.B.*	lb.	2.30	2.65

Red

Akron Masterbatches*	lb.	1.30	3.68
Toners*	lb.	.98	5.60
Arcturus Reds*	lb.	—	1.35
Antimony Trisulfide	lb.	.72	.78
R.M.P. Sulfur Free*	lb.	—	.78
R.M.P. No. 3*	lb.	—	.72
Bonadur 20-6440	lb.	—	1.90
20-6540	lb.	—	2.00
Brilliant Toning Reds*	lb.	1.77	1.90
Cadmolith Red* (dms.)	lb.	1.94	2.87
Clarion 20-7150	lb.	—	1.35
Cooke M.B. Red*	lb.	1.05	3.25
410*	lb.	—	1.75
Disco Reds	lb.	1.05	3.25
Graphic Red* (dlvd.)	lb.	.98	1.03
Harmon Electra Red Toner	lb.	—	3.45
Lithol Rubine Toner R-6142	lb.	—	1.60
Pyrazolone Red Toner	lb.	—	1.40
Rincon Red Tones	lb.	—	1.90
Hi-Fiz Fluorescent	lb.	1.15	2.15
Kroma Reds*	lb.	.14¼	.14½
Lake Red C*	lb.	—	1.25
Mapico Reds* (50 lb. bags)	lb.	.14¼	.14½
Mercadium X-2668 Light*	lb.	—	1.72
X-2669 Medium Light*	lb.	—	1.80
X-2670 Medium*	lb.	—	1.87
X-2671 Dark*	lb.	—	1.95
Naphthol 20-7575	lb.	—	3.80
Oximony Red Iron Oxide	lb.	.14¼	.14½
Plasticone Red*	lb.	1.02	4.60
Polaris Red*	lb.	—	1.70
Recco Red Oxide*	lb.	.13½	.13¾
Red Iron Oxide, Light	lb.	.14¼	.14½
Red Powders	lb.	—	4.40
Rubber Dispersed Reds	lb.	1.47	3.58
Rubber Red PBD* (Disp.)	lb.	—	2.05
2BD, Dispersed*	lb.	—	2.00
2BL*	lb.	1.24	1.24
PBL*	lb.	1.24	1.24
Rubanox Reds*	lb.	1.47	1.60
Rubber Red CP-339* (dlvd.)	lb.	—	1.10
Rubber Red X-1148*	lb.	—	.98
Solfast Red*	lb.	1.47	1.80
Stan-Tone MBS*	lb.	1.00	3.75
GPE*	lb.	.70	3.05
PC*	lb.	1.10	1.45
Vansul Red M.B.*	lb.	1.00	3.35
Watchung Red*	lb.	1.90	1.90

Tan

Mapico Tan 15* (50 lb. bags)	lb.	.23¼	.23½
20* (50 lb. bags)	lb.	.23¼	.23½

White—Lithopone

Permolith*	lb.	.0825	.09125
Sunolith*	lb.	.0800	.0875

White—Titanium Pigments

Iceberg*	lb.	—	.0265
Icecap K*	lb.	—	.03¼
Horse Head Anatase Grades*	lb.	.25½	.26½
Rutile Grades*	lb.	.27½	.28½
Stan-Tone PC*	lb.	.55	.60
Ti-Cal*	lb.	.09	.09¾
R-22*, R-25*, R-27*, R-30*	lb.	.09⅜	.09⅞
R-60*	lb.	.09⅝	.10⅛
Ti-Pure*	lb.	.24½	.27½
Anatase Grades*	lb.	.25½	.26½
R-100*, R-500*	lb.	.27½	.28½
Titanox A*—all grades (dlvd.)	lb.	.25½	.26½
C-50* (dlvd.)	lb.	.14⅜	.14⅞
RA* (dlvd.)	lb.	.27½	.28½
RA-10* (dlvd.)	lb.	.27½	.28½
RA-NC* (dlvd.)	lb.	.27½	.28½
RC* (dlvd.)	lb.	.09⅜	.10⅛
RC-HT* (dlvd.)	lb.	.09⅜	.09⅞

COLORING AGENTS (Cont'd)

White—Titanium Pigments (Cont'd)

Unitane O-110*	lb.	.25½	.26¼
O-220*	lb.	.25½	.26½
O-310*	lb.	.25½	.26½
OR-150*	lb.	.27½	.28½
OR-250*	lb.	.27½	.28½
OR-340*	lb.	.27½	.28½
OR-342*	lb.	.27½	.28½
OR-350*	lb.	.27½	.28½
OR-540*	lb.	.27½	.28½
OR-640*	lb.	.27½	.28½
Zopaque*	lb.	.24½	.25½
R*	lb.	.26½	.27½

White—Zinc Oxide (American Process)

AZODOX 44, 45	lb.	.1450	.1550
AZO-ZZZ 11*, 22*, 33*, 44* 55*	lb.	.1450	.1550
Eagle-Picher AAA*	lb.	.1450	.1550
Horse Head Special*	lb.	.1450	.1550
XX*	lb.	.1450	.1550
Protox 166*	lb.	.1450	.1550
167*	lb.	.1450	.1550
267* (pelleted)	lb.	.1450	.1550
St. Joe Black Label* 20, 20-21	lb.	.1450	.1550
Red Label* 30, 31	lb.	.1450	.1550
Green Label* 12, 46 (latex only)	lb.	.1450	.1550
Green Label* 42, 42-21, 42A-3, 43 Pelets	lb.	.1450	.1550

White—Zinc Oxide (Dispersed)

Dispersed Zinc Oxide	lb.	—	.13

White—Zinc Oxide (French Process)

AZO-ZZZ 66	lb.	.1450	.1550
Florence Green Seal*	lb.	.1625	.1725
Red Seal*	lb.	.1575	.1675
White Seal*	lb.	.1675	.1775
Kadox 25*	lb.	.1500	.1600
15*, 17*, 72* & 515	lb.	.1450	.1550
Protox 168*	lb.	.1450	.1550
169*	lb.	.1450	.1550
268* (pelleted)	lb.	.1450	.1550
U.S.P. (cartons)	lb.	.1775	.1875
XX-78*	lb.	.1450	.1550

White—Zinc Sulfide

Cryptone ZS*	lb.	.2530	.2630
Lehigh 12%*	lb.	.1250	.1350
18%*	lb.	.1400	.1500
35%*	lb.	.15375	.16375
50%*	lb.	.1575	.1675

Yellow

Akron Masterbatch*	lb.	1.27	2.48
Toners*	lb.	2.20	6.00
Benzidene-Lightfast	lb.	3.40	5.35
Benzidine Yellow	lb.	1.41	2.55
Cadmolith Yellow (dms.)	lb.	—	1.19
Chrome Yellow	lb.	.35	.35
Cooke M.B. Yellow 405*	lb.	2.15	2.75
Disco Yellows	lb.	2.05	3.95
Harmon Benzidene Yellow Toner YB-2	lb.	—	2.25
Fanchon Yellow Toner	lb.	—	2.20
Hi-Fiz Fluorescent	lb.	1.60	2.60
Iron Oxide, Pure Light Shades	lb.	.12½	.12¾
Dark Shades	lb.	.12	.12¼
Mapico Yellow* (50 lb. bags)	lb.	.12	.12¼
Rubber Dispersed Yellows	lb.	1.27	2.13
Rubber Yellow GD* (disp.)	lb.	—	2.25
GL*	lb.	—	1.68
Rubber Yelow X-1940*	lb.	—	2.25
Stan-Tone Cadmium Dry*	lb.	2.80	3.03
Cadmium Paste	lb.	1.72	1.82
MBS*	lb.	1.30	2.20
GPE*	lb.	.70	3.25
PC*	lb.	.55	3.50
Toluidine Yellow	lb.	2.20	2.20
YL-660 D*	lb.	1.25	1.35
Oximony Iron Oxide	lb.	.14¼	.14½
Vansul Yellow M.B.*	lb.	1.15	2.15
Yellow Powders	lb.	2.00	5.00
Zinc Yellow	lb.	.29	.29

DISPERSING AGENTS

Anchoid*(†)	lb.	.24	.25
Anhydrapent*	lb.	.56	.59
Armeen 18*	lb.	.39	.43
Belloid TD*	lb.	.15¾	.16¼
Blancol*	lb.	—	.15¼
Darvan No. 1*, No. 2*, No. 3*	lb.	.22	.35
No. 6*	lb.	.15¼	.15¾
No. 7*	lb.	.18¾	.23¾
Daxad 11* (21*, 23*)	lb.	.08	.30
Diethanolamine (dms., dlvd.)	lb.	.24½	.27
Dispersaid*	lb.	1.25	1.35
Emcol K-8300* (dms.)	lb.	.14	.18
P10-59	lb.	.32	—
5120	lb.	.31	—
5138	lb.	.31	—
Emulphor ON-870*	lb.	—	.55
Furala*	lb.	.06½	.07½
Halloid*	lb.	.04½	.05½
Igepal CO-630*	lb.	—	.70
Igepon T-73*	lb.	—	.29½
Kyro EO* (dms.)	lb.	—	.24¼
Leonil SA*	lb.	—	.55

DISPERSING AGENTS (Cont'd)

Lipal No. 9-N*	lb.	.28	.29
11-O*	lb.	.28	.29
Lomar PW*	lb.	.15¼	.15¾
Marasperse C*	lb.	.06¼	.06¾
CB*	lb.	.15	.17
N*	lb.	.09½	.10½
Monoethanolamine (dms., dlvd.)	lb.	.25	.27½
Naccosol A (dlvd.)	lb.	—	.52
Naccotan A*	lb.	.16½	.17
Nekal BA-75*	lb.	—	.40
BX-78*	lb.	—	.64
Nopcosant*	lb.	.15¼	.15¾
Pluronic F68*	lb.	.38½	.44
Polyfon*	lb.	.08	.10
R & R 551*	lb.	—	.28
Stablex B*	lb.	.50	.95
Stan-Chem BQC*	lb.	.12¼	.17¼
1067*	lb.	—	.13½
1471*	lb.	.1687	.2187
2251*	lb.	.12¼	.17¼
Trenamine D-25*	lb.	.32½	.36
Triethanolamine (dms., dlvd.)	lb.	.22	.25½
Yelkin TT* (and TTS*)	lb.	.13	.16

EXTENDERS

Arcco 1294-36B*	lb.	.11½	.12½
Car-Bel-Ex-A*	lb.	—	.144
Extender 600*	lb.	—	.1870
Facile Gum 4A*	lb.	.48	.50
Milex*	lb.	—	.07
W*	lb.	—	.07
Nopco 2271*	lb.	.16¾	.18¾
OPD*	lb.	.29	.40
Polyco 418*	lb.	.17	.18
PR-162 Latex Extender*	lb.	—	.182
Solvitose HDF*	lb.	.22	.25
Synprolac*	lb.	.16	.23
Synpruwax*	lb.	—	.23
Vanadiset B*	lb.	.0360	.07
C*	lb.	.0310	.06
MR* 80 mesh	lb.	.08½	.12¼
Vistanex MM Grades*	lb.	—	.35
Wilcarbo Carbon Powders*	lb.	.08	.15

FILLERS (Inert and Reinforcing)

Abrasives			
Carbonite*	lb.	.21½	1.35
Liomite*	lb.	.16	1.27
Pumice	lb.	.03	.05
Walnut Shell Grits	ton	60.00	-110.00
Aluminum Hydrate	lb.	.031	.170
Kaiser Aluminum Hydrate*	lb.	.035	.065
Aluminum Silicate			
AFD*	ton	29.50	36.00
Aluminum Flake*	ton	29.50	36.00
Marter White*	ton	18.50	30.00
Barium Carbonate (l.c.l.)	ton	109.00	-126.50
Barytes			
No. 1 Floated, White*	ton	55.00	79.85
No. 2 Floated, Unbleached*	ton	50.00	74.85
No. 22 Barytes* (c.l.)	ton	—	30.00
No. 3805 Barytes*	ton	22.00	26.75
Foam A*	ton	60.00	84.85
Sparmite*	ton	80.00	90.00
XIOR*	ton	90.00	95.00
Bentonite (c.l.)	ton	—	13.50
Argosite Clay* (c.l.)	ton	—	12.50
Bennett Clay* (c.l.)	ton	—	32.50
SPV Volclay* (c.l.)	ton	—	13.50
White Hi-Gel*	ton	—	65.90
Blanc Fixe	ton	125.00	-142.00
Calcium Carbonate			
Allied Whiting	ton	—	11.50
Atomite* (c.l.)	ton	32.50	35.00
B.I. White No. 1 (c.l.	ton	—	10.00
Calcene NC*	ton	80.00	-100.00
TM*	ton	82.50	-102.50
Calwhite*	ton	20.00	25.00
T*	ton	25.00	30.00
Camel-Carb*	ton	—	14.00
Camel-Tex*	ton	—	22.00
Camel-Wite*	ton	—	35.00
Carbium	ton	30.00	40.00
CCO White*	ton	—	22.00
Duramite*	ton	20.00	22.00
Gamaco* (c.l.)	ton	32.50	37.50
T*	ton	37.50	42.50
GamaKal*	ton	37.50	42.50
Georgia Marble 5-25* (c.l.)	ton	—	20.00
No. 10 White* (c.l.)	ton	—	11.00
Kalite*	ton	52.50	67.50
Kalmac*	ton	23.00	28.00
Laminar*	ton	—	30.00
Lesamite* (c.l.)	ton	—	27.50
Lorite*	ton	30.00	36.00
Millical*	ton	38.00	53.00
Multifex MM*	ton	117.50	-137.50
Non-Fer-Al*	ton	35.00	50.00
Purecal M*	ton	65.00	85.00
SC* (and T*)	ton	117.50	-137.50
U*	ton	127.50	-142.50
PPTD* (c.l.)	ton	—	30.00
Rambo No. 1*	ton	—	11.50
Snowflake*	ton	20.00	22.00
Super Multifex*	ton	167.50	-187.50
Surfex*	ton	42.00	57.00
Suspenso*	ton	38.00	43.00
Witcarb Reg.*	ton	60.00	85.00
R*	ton	127.50	-150.00
RC*	ton	117.50	-140.00
York White*	ton	—	11.50

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2365 rubber compounds on individual punched cards presorted first by polymer, then each polymer grouped into black and nonblack subgroups, further subdivided by hardness and then by tensile.

115	compounds	for natural rubber, black
154	"	for natural rubber, nonblack
276	"	for styrene rubber, black
150	"	for styrene rubber, nonblack
259	"	for nitrile rubber, black
97	"	for nitrile rubber, nonblack
254	"	for neoprene, black
116	"	for neoprene, nonblack
101	"	for butyl, black
57	"	for butyl, nonblack
50	"	for polysulfide, black and nonblack
36	"	for reclaim (all black compounds)
45	"	for Hypalon, black and nonblack
86	"	for silicone rubber, black and nonblack
92	"	for vinyls (all nonblack compounds)
100	"	for miscellaneous other rubbers, black and nonblack
156	"	for blends of general purpose rubbers (natural, styrene, butyl, reclaim), black
71	"	for blends of general purpose rubbers, nonblack
77	"	for blends containing oil-resistant rubbers, black
73	"	for blends containing oil-resistant rubbers, nonblack
2365	compounds	Total

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COMPANY

ADDRESS

CITY—STATE

FILLERS (Cont'd)

Calcium Silicate			
Silene EF*	lb.	.06	.06½
Calcium Sulfate, Anhydrous			
Snow White Filler*	ton	——	22.00
Calcium Sulfate Hydrous			
Terra Alba No. 1*	ton	——	17.00
Chalk Whiting (l.c.l.)	lb.	.01½	.01¾
Recco Paris Whiting*	ton	——	35.00
OMYA Whiting*	ton	——	35.00
Clay			
Afton Clay*	ton	13.00	38.00
Aiken Clay*	ton	14.50	——
Akron HC-100*	ton	14.50	——
HC-75*	ton	13.00	——
SC-25*	ton	14.50	——
Alsilite* (c.l.)	ton	30.00	45.00
Aluminum Flake*	ton	25.50	28.50
Barden R*	ton	8.50	13.00
Buca* (c.l.)	ton	——	45.00
Burgess No. 20*	ton	——	33.00
No. 30*	ton	——	40.00
Burgess Iceberg*	ton	——	53.00
Icecap K*	ton	——	65.00
Catalpo* (c.l.)	ton	33.00	——
Champion*	ton	——	14.50
Crown*	ton	——	14.50
Dixie* (c.l.)	ton	——	14.50
Dover*	ton	——	13.00
Franklin Clay—R* (c.l.)	ton	16.00	41.50
G. K. Soft*	ton	11.50	32.00
Glomax HE (bags)	ton	65.00	——
LL (bags)	ton	53.00	——
PVR (bags)	ton	40.00	——
WZ (bags)	ton	45.00	——
Harwick Clays*	ton	21.50	77.00
Hydrite RS (bags)	ton	30.00	——
PXS (bags)	ton	45.00	——
UF (bags)	ton	100.00	——
10S (bags)	ton	50.00	——
Flat "D" (bags)	ton	25.00	——
Hi-White R*	ton	10.00	14.50
Kaolloid Clay* (c.l.)	ton	——	10.50
LGB*	ton	13.00	17.50
LGP*	ton	15.50	20.00
McNamee* (c.l.)	ton	——	14.50
Natka 1200	ton	13.00	36.00
Par* (c.l.)	ton	——	12.00
Paragon*	ton	10.00	14.50
Pigment 5*	ton	27.50	34.50
33*	ton	——	40.00
Polyfil 40	ton	40.00	——
70	ton	53.00	——
90	ton	65.00	——
C	ton	25.00	——
F	ton	45.00	——
X	ton	30.00	——
Recco* (c.l.)	ton	——	14.50
Swanee Clay*	ton	——	12.50
Snobrite*	ton	——	12.50
Suprex*	ton	10.00	14.50
Whitetex* (c.l.)	ton	53.00	——
Windsor*	ton	14.50	39.50
4200 Clay*	ton	13.00	——
Diatomaceous Earth	ton	30.00	50.00
Celatom MN-33	ton	36.00	95.00
MP-25	ton	55.00	121.00
MP-63	ton	55.00	121.00
Celite 270	ton	55.00	121.00
292	ton	36.00	95.00
315; 350	ton	137.00	225.00
Kaylorite* (c.l.)	ton	——	30.00
Lorite*	ton	——	36.00
Flock			
Cotton (White)	lb.	.28	.30
Colored	lb.	.12	.20
Filfloc F 40-9000*	lb.	——	.13
F 6000*	lb.	——	.36
Nylon	lb.	——	.35
Potycel*	ton	110.00	210.00
Rayon, Bleached or Dyed	lb.	.75	1.20
Rayon, Grey	lb.	——	.18
Rayon, Pink	lb.	——	.20
Solka-Floc* (l.c.l.)	lb.	.07	.16
Glue, Amber	lb.	.17	.19
Ground Softwood Bark			
Silvacon* (c.l.)	ton	55.00	100.00
Leather			
Flour (dust)	lb.	.12	.15
Shredded	lb.	.05	.17
Lignin	lb.	.06	.08
Limestone, Pulverized	ton	3.00	5.00
Asbestol Regular*	ton	28.00	——
Asbestol Superfine*	ton	33.00	——
Georgia Marble No. 10*	ton	——	11.00
Industrial Filler No. 100*	ton	——	7.75
Micro Velva A*	ton	53.00	——
L*	ton	61.00	——
No. 1 White*	ton	——	11.00
Magnesium Carbonate	lb.	.10½	.13
K & M Technical* (c.l., eqld.)	lb.	.10½	.12
Marinco CL*	lb.	.11	.13
Michigan*	lb.	.11	.15
Magnesium Silicate (see Talc)			
Mica	lb.	.01¾	.07½
Concord*	lb.	.08	.08¾
Micro-Mica*	lb.	.08	.08¾
Mineralite* (c.l.)	ton	40.00	85.00
Silversheen*	lb.	.08	.08¾
Triple A Mica* (c.l.)	ton	——	40.00
Vermiculite*	ton	——	.11
Wet Ground Biotite Mica	lb.	.06½	.07¼
Wet Ground Mica No. 160*	lb.	.08	.08¾

FILLERS (Cont'd)

Pecan Shell Flour			
Stan Shell*	ton	45.00	75.00
Pyrophyllite			
No. 261*	ton	——	11.50
Pyrax A* (c.l.)	ton	14.50	15.00
WA* (c.l.)	ton	17.00	17.50
Sawdust, Graded	ton	14.00	35.00
Silica	ton	16.00	27.00
Extra Fine (bags) (c.l.)	ton	——	43.00
Slate, Powdered (l.c.l.)	ton	15.00	20.00
Lo-Micron Slate Flour*	lb.	——	.04½
No. 133 Slate Flour*	ton	——	4.55
Sodium Silico Aluminate			
Zeolex 23*	lb.	.06	.07
Talc (Magnesium Silicate)			
Akron Soapstone*	ton	——	9.75
Asbestol Regular*	ton	——	27.00
Eastern RC-500*	ton	——	32.00
No. 41*	ton	——	19.70
No. 549*	ton	——	63.00
French*	ton	——	59.00
No. 367*	ton	——	13.00
No. 1600*	ton	——	70.60
No. 1768*	ton	——	13.00
Nytal 200* (c.l.)	ton	——	28.00
300* (c.l.)	ton	——	38.00
Sierra Fibrene C-400*	ton	34.00	40.00
Sierra Supreme 325*	ton	51.00	56.00
Sierra White*	ton	21.75	26.75
Soapstone*	ton	——	13.00
Walnut Shell Flour	ton	55.00	100.00
Agrashell*	ton	55.00	115.00
Stan-Shell*	ton	50.00	110.00
Whiting, Commercial	ton	——	7.50
Allied Whiting*	ton	——	11.50
Camel-Carb*	ton	——	10.00
Calwhite (c.l.)	ton	——	20.00
C-C-O White*	ton	——	22.00
Georgia Marble No. 15*	ton	——	20.00
No. 10*	ton	——	20.00
Piqua No. 1 YAA* (c.l.)	ton	10.00	10.00
No. 2 LS* (c.l.)	ton	10.00	10.00
Snowflake* (c.l.)	ton	20.00	22.00
Stan-White 325*	ton	11.50	14.10
Ultrasil*	lb.	.35	.50
Veroc* (c.l.)	ton	——	11.50
Welco* (c.l.)	ton	——	10.50
York White R* (c.l)	ton	——	11.00
Wood Flour	ton	31.50	48.00

FINISHING MATERIALS, SURFACE

Beaco Finishes*	gal.	2.10	2.35
Black Out*	gal.	4.50	8.00
Calcium Hypochlorite (dms.) (cwt.)	ton	33.30	37.90
Shellac, Orange Gum	lb.	.35	.45
VanWax*	gal.	2.00	2.05

FLAME RETARDANTS

Celluflex CEF* (dms.)	lb.	——	.65
Chlorowax 40*	lb.	.15	.17½
50*	lb.	.16	.18½
70*	lb.	.18½	.20
Halowax*	lb.	.36	.46
Zinc Borate 3167*	lb.	.1920	.2020
Zyrox Compounds*	lb.	.38	.95¼

LATEX MODIFIERS

Crux*	lb.	.30	.65
Foamnix*	lb.	.60	1.50
Ludox	lb.	.15	.16¾
Nopco EB*	lb.	.16¾	.18¾
EB-1*	lb.	.16¾	.18¾
EB-5*	lb.	.19½	.21½
OPD-101*	lb.	.29	.40
Piccopale A-1 Emulsion	lb.	.086	.113
A-20	lb.	.089	.116
A-22	lb.	.097	.124
A-41; A-43	lb.	.0775	.0145
C-1	lb.	.091	.118
N-3	lb.	.100	.127
STAYB*	lb.	.25	.45
Syton 200	lb.	.15	.16¼
Ubatol U-2001* (t.c.)	lb.	.166	.187
U-2003* (t.c.)	lb.	.184	.208
U-2007* (t.c.)	lb.	.166	.187
U-3025* (c.l.)	lb.	.223	.235
U-3040* (c.l.)	lb.	.260	.272
U-3045* (c.l.)	lb.	.260	.272
U-3050* (c.l.)	lb.	.195	.207
Webnix*	lb.	1.25	2.00

LUBRICANTS, MOLD

Akro Gel*	lb.	——	.165
Alipal CO-433*	lb.	——	.20
CO-436*	lb.	——	.24
Aluminum Stearate Crown Brand*	lb.	.37	.42
Amine, Mixed Crude*	lb.	.19	.25
Aquadag*	lb.	3.50	4.00
Aquarex D*	lb.	——	.81
L*	lb.	——	.94
ME*	lb.	——	.82
MDL*	lb.	——	.33
WAQ*	lb.	——	.22
Armeen HT*	lb.	.34	.40
180*	lb.	.52	.56
Armid HT (flaked)*	lb.	.42	.46
0*	lb.	.39	.41
Borax Granular (l.c.l.)	ton	89.00	94.00

LUBRICANTS, MOLD (Cont'd)

Carbowax 4000*	lb.	.31	.32
CD Mold Release B*	gal.	5.00	——
B-2*	gal.	5.00	——
Colite Concentrate* (dms.)	gal.	.90	1.15
Colite D43D*	gal.	1.15	1.40
Concentrex*	lb.	——	.25
Dag Dispersion No. 197*	lb.	1.95	2.90
D.C. 7 Compound*	lb.	4.70	5.80
D.C. Emulsion No. 7*	lb.	1.59	2.07
No. 8*	lb.	1.15	1.69
No. 35*; 35A*	lb.	1.15	1.69
No. 35B*	lb.	1.15	1.69
No. 36*	lb.	1.15	1.69
D.C. Mold Release Fluid*	lb.	2.90	3.47
Dri-Lube*	lb.	——	.22
Dry-Flo* (50 lb. bags)	lb.	21.40	——
Emulsion Lubricant A80*	lb.	——	1.20
45*	lb.	——	1.20
G-E Silicone Emulsion SM 55*	lb.	1.15	1.69
SM 61*	lb.	1.15	1.69
SM-62*	lb.	1.15	1.69
G-E Silicone Fluid SF-92*	lb.	2.90	4.05
SF-96*	lb.	2.90	4.05
Hawkeye Flake* (dlvd.)	lb.	.11½	.13¼
Igepal CO-430*	lb.	——	.29
CO-630*	lb.	——	.29
CO-530*	lb.	——	.29
Igepon AP-78*	lb.	——	.48
T-33*	lb.	——	.21
T-51*	lb.	——	.13½
Kokobace R*	lb.	.17¼	.18½
Lipal 9-N*	lb.	.28	.29
7-O*	lb.	.29	.30
Lubrex	lb.	.25	.30
Lubri-Flo*	gal.	10.00	12.00
Migralube*	lb.	——	.35
ML-1027-2C*	gal.	——	2.65
ML-1028-2C*	gal.	——	2.65
Mold Lubricant No. 72 Conc.* (dms.)	gal.	——	1.90
Mold Lubricant No. 426* (d.ms.)	lb.	.18	.17
No. 735* (dms)	gal.	——	1.25
No. 769* (dms.)	gal.	——	1.20
No. 825* (dms.)	gal.	——	2.00
No. 856* (dms.)	gal.	——	1.90
No. 880* (dms.)	gal.	——	1.19
No. 887* (dms.)	gal.	——	1.80
No. 935* (dms.)	gal.	——	1.56
No. 956* (dms.)	gal.	——	2.50
No. 965* (dms.)	gal.	——	2.15
No. 967* (dms.)	gal.	——	2.40
No. 969* (dms.)	gal.	——	1.50
No. 970* (dms.)	gal.	——	4.50
No. 975* (dms.)	gal.	——	2.85
No. 980* (dms.)	gal.	——	1.53
No. 987* (dms.)	gal.	——	2.45
A 187* (dms.)	gal.	——	1.90
A 256* (dms.)	gal.	——	1.20
A 988* (dms.)	gal.	——	2.60
Moldeze No. 3*	gal.	——	4.95
Mold-Brite*	gal.	——	1.50
Monopole Oil MD*	lb.	——	.16
MR-22 Silicone Semi-Permanent	gal.	9.95	14.95
Olate Flakes*	lb.	.23½	.24¼
Orvus WA Paste* (dms.)	lb.	——	.23¼
Plaskon Polyethylene S*	lb.	.32	.47
Poly-Brite PE-20	lb.	.28	.42
600	lb.	.42	.58
Poly-Cone 125X	lb.	1.15	1.30
1,000	lb.	.91	1.04
Polyglycol 15-200*	lb.	.25	.28¼
E4000*	lb.	.31	.37
Prodag*	lb.	.32	.60
Purity Flake* (dlvd.)	lb.	.14¾	.16½
Rubber-Flo*	gal.	1.25	2.00
Rubber-Glo*	gal.	——	.94
Rusco Mold Paste*	lb.	.25½	.32
Sericite* (l.c.l.)	ton	65.00	75.00
Silicone Oil A145*	lb.	3.22	3.61
A220* (dms.)	lb.	——	2.80
Silrex (dms.)	lb.	——	.65
Rubars*	lb.	——	.22¾
Soybean Lecithin	lb.	.13	.17
Thermalube*	lb.	——	.13¾
UC Silicone L-45*	lb.	2.90	4.61
L-522*	lb.	2.68	3.50
LE-45*	lb.	1.15	1.69
LE-450*	lb.	1.15	1.69
Ucon Lubricants*	lb.	.26¾	.27¾
Ulco Mold Soap*	lb.	.19	.29

LUBRICANTS, RUBBER

Cyclolube NN-1; NN-2; NN-3	gal.	.12½	.20½
NN-4	gal.	.13½	.21½
114	gal.	.19	.27
4053	gal.	.21	.29
Diglycol Stearate Neutral (and SE) (dms.)	lb.	——	.25
Extrud-o-Lube*	gal.	1.33	1.54
Ivory Chips*	lb.	.19¾	.20¾
LatexLube GR* (dlvd)	lb.	.19¼	.21½
No. 82-A* (450 lb. dms.)	lb.	——	.08½
Nopcowax 22-DS*	lb.	.38½	.41
Propylene Stearate (dms.)	lb.	.35	.60
Versa-Lube B*	lb.	.16	.18

LUBRICANTS, RUBBER SURFACE

Antidust	lb.	.37 -	.41
Barium Stearate	lb.	.41 -	.46
Calcium Stearate	lb.	.39 -	.44
Crown Brand*	lb.	.37 -	.42
D.C. 7 Compound*	lb.	4.70 -	5.80
D.C. 200 Fluid*	lb.	2.90 -	3.47
ELA*	lb.	— -	.82
G-E Silicone Fluid SF-92*	lb.	3.04 -	4.25
Glycerized Lubricant*	gal.	1.25 -	1.48
Glydag B*	lb.	1.00 -	2.25
Glyso-Lube* (dms.)	lb.	— -	.14
No. 3* (dms.)	lb.	— -	.14
Hydro-Zinc*	lb.	— -	.20
Latex-Lube Pigmented* (dlvd.)	lb.	.17¼ -	.19¼
R-66*	lb.	— -	.17¼
Liqui-Lube* (dlvd.)	lb.	— -	.17¾
N.F.* (dlvd.)	lb.	— -	.17¾
N.T.* (dlvd.)	lb.	— -	.16¾
Lubrex*	lb.	.27 -	.32
Lubri-Cote	gal.	.86 -	1.00
Magnesium Stearate	lb.	.42 -	.47
Crown Brand*	lb.	.40 -	.45
Polyethylene Glycol	lb.	.22 -	.26
Rexanol*	lb.	— -	.13
Rubber Free (Concentrate)*	gal.	— -	1.44
Jel*	lb.	.18 -	.21½
Separex*	lb.	.08½ -	.10½
Slab-Dip* (dms.)	lb.	— -	.17
Soybean Lecithin	lb.	.13 -	.17
Stock-Lube*	lb.	— -	.14
UC L-45*	lb.	2.90 -	4.61
L-522*	lb.	2.68 -	3.50
LE-450*	lb.	1.15 -	1.69
XL-42*	lb.	3.10 -	4.75
XLE-42*	lb.	1.22 -	1.70
XLE-420*	lb.	1.18 -	1.70
Wet Zinc*	lb.	— -	.22¼
CW*, P*	lb.	— -	.20
Zinc Stearate	lb.	.41 -	.46

MOLD CLEANERS

Actusol* (dlvd.)	gal.	1.45 -	1.65
Alkon* (dlvd.)	lb.	.16 -	.16½
CA-301*	gal.	— -	2.49
CA-302*	gal.	— -	2.63
G-O 6910*	lb.	.38 -	.40
Metso Anhydrous*	cwt.	5.70 -	7.95
Metso 99*	cwt.	5.00 -	7.25
200*	cwt.	6.70 -	8.95
Granular*	cwt.	4.45 -	6.70
Orvus Extra Granules*	lb.	.23¼ -	.24¾
Polo*	lb.	.12¾ -	—
Rubber-Sol*	gal.	2.97 -	3.97
Shelblast*	lb.	.04 -	.08¼
Sprex A.C.* (dlvd.)	lb.	.17¾ -	.18¾
Zip Mold Cleaner*	gal.	1.05 -	1.55

PEPTIZING AGENTS

Peptizer P-12*	lb.	.95 -	1.25
Pepton 22 Plasticizer*	lb.	.83 -	.86
65*	lb.	1.23 -	1.26
65B*	lb.	.83 -	.86
Pitt-Consol 640 (dms.)	lb.	— -	.42
RPA 2*	lb.	— -	.85
3*	lb.	— -	.51
3 Conc.*	lb.	— -	.85
6*	lb.	— -	1.66

PLASTICIZERS & SOFTENERS

Actisil	lb.	.26 -	.27
Acto 500*	lb.	— -	.09
Adipol BCA*	lb.	.47 -	.47½
2EH*	lb.	.42½ -	.44
10A*	lb.	.42½ -	.44
ODY*	lb.	.42½ -	.44
810*	lb.	.42½ -	.45½
XX*	lb.	.42½ -	.44
Admex 562 (dms.)	lb.	.50¾ -	.51¾
710 (dms.)	lb.	.35¾ -	.36¼
711 (dms.)	lb.	.37¾ -	.38¼
744 & 745 (dms.)	lb.	.41¾ -	.42¼
760 (dms.)	lb.	.59¾ -	.60¾
761 (dms.)	lb.	.46¾ -	.47¼
770 (dms.)	lb.	.42¼ -	.43
Anhydrol 6990*	lb.	.51 -	.56
Arneel SD*	lb.	.34 -	.40
Arolene 1980* (c.l.)	lb.	— -	.10
Aromatic Plasticizer 10* (and 25*) (dms.)	lb.	.08 -	.08½
Aromatic Tar	gal.	.0573 -	.1973
Bardol*	lb.	.02¾ -	.03¾
B*	lb.	.06¼ -	.06½
Bayol D*	gal.	— -	.382
F*	gal.	— -	.52
Bearflex 1751*	lb.	.14 -	.15
LPO*	lb.	.03 -	.04
MPO*	lb.	.03¾ -	.04¾
Beeswax, Bleached	lb.	.73 -	.75
Yellow Refined	lb.	.64 -	.65
Bondogen*	lb.	.55½ -	.60½
B.R.C. No. 20*	lb.	.0150 -	.0175
No. 21*	lb.	.02¾ -	.03
No. 22*	lb.	.02½ -	.03¾
B.R.H. 2*	lb.	.0213 -	.0351
BRS 700*	lb.	.0200 -	.0285
B.R.T. 3*	lb.	.0180 -	.0265
4*	lb.	.0250 -	.0260
7*	lb.	.0300 -	.0310

PLASTICIZERS & SOFTENERS (Cont'd)

B.R.V.*	lb.	.0475 -	.0565
Bunarex Resins*	lb.	.07 -	.08
Bunatak AH*	lb.	— -	.09½
N*	lb.	— -	.31
U*	lb.	— -	.17½
No. 90*	lb.	— -	.09
No. 210*	lb.	— -	.14
Butac*	lb.	.1635 -	.1735
Butyl Carbitol Pentargonate (dms.)	lb.	— -	.04½
Butyl Cellosolve Perlargonate (dms.)	lb.	— -	.68
Butyl Oleate	lb.	.26 -	.27
Butyl Palmitate	lb.	— -	.26½
Butyl Stearate (dms.)	lb.	.26 -	.27
Byerflux*	gal.	.24 -	.27
Califlux 510* (and 550*)	lb.	.02¾ -	.03¾
G.P.*	lb.	.01½ -	.02½
R-100*	lb.	.04¾ -	.05¾
LBL*	gal.	.17 -	.25
OSR*	lb.	.01⅞ -	—
RC*	gal.	.13½ -	.21½
TT*	lb.	.0195 -	.0295
Candelilla Wax, Prime	lb.	.53 -	.64
Refined Light	lb.	.56 -	.60
Carbowax 4000* (dms.)	lb.	.68 -	.70
Cardolite NC-103*	lb.	.36 -	.59
Carnauba Wax, Crude	lb.	.73 -	.74
Flaked	lb.	.73 -	1.25
Refined, Technical	lb.	.73 -	.74
Refined, Pure	lb.	.82 -	.86
Yellow	lb.	1.10 -	1.15
Celluflex* (dms.)			
112* (t.c., dlvd.)	lb.	— -	.32½
179-A* (t.c., dlvd.)	lb.	— -	.32½
179-C* (t.c., dlvd.)	lb.	— -	.32½
179-EG* (t.c., dlvd.)	lb.	— -	.32½
DBP* (t.c., dlvd.)	lb.	— -	.30
DOP* (t.c., dlvd.)	lb.	— -	.28½
TPP* (dms., eqld.)	lb.	— -	.40
Ceresin Wax	lb.	.12 -	.30
Chlorowax 40*	lb.	.15 -	.17½
50*	lb.	.16 -	.18½
70*	lb.	.18½ -	.20
LV*	lb.	.17 -	.19½
CTLA Polymer*	gal.	.20 -	.36
Cumar Resins*	lb.	.07 -	.19
Cyclolube OSR*	gal.	.28 -	.36
Darex DBM*	lb.	.30½ -	.34
DBP*	lb.	.30 -	.33½
DOP*	lb.	.30½ -	.33½
DIOP*	lb.	.30½ -	.33½
D.B.M.*	lb.	.32 -	.34¼
Decylbutyl Phthalate	lb.	.27 -	.29½
Degras, Common	lb.	— -	.14
Diallyl Phthalate	lb.	.51½ -	.52½
Dibenzyl Sebacate (dms.)	lb.	.93 -	.93½
Dibutoxyethyl Sebacate	lb.	— -	.61½
Dibutyl Phthalate (dms.)	lb.	.31 -	.32½
Dibutyl Sebacate	lb.	.67½ -	.68
Dicapryl Adipate (dms.)	lb.	.41½ -	.42½
Dicapryl Phthalate (dms.)	lb.	.27½ -	.29
Dicaprvl Sebacate	lb.	.58 -	.59½
Di-Carbitol Phthalate (dms.)	lb.	.50 -	.50¼
Dicyclohexyl Phthalate	lb.	.45 -	.46½
Diethyl Phthalate (dms.)	lb.	.29 -	.30½
Di-2-ethylhexyl Phthalate (dms.)	lb.	.28½ -	.30
Dihexyl Adipate (dms.)	lb.	.46½ -	.47½
Dihexyl Phthalate (dms.)	lb.	.32½ -	.33½
Dihexyl Sebacate (dms.)	lb.	.66 -	.66½
Diisobutyl Azelate	lb.	— -	.47¼
Diisobutyl Phthalate	lb.	.29½ -	.31
Di-iso-octyl Adipate	lb.	.42½ -	.43½
Dimethyl Phthalate (dms.)	lb.	.29 -	.30½
Dimethyl Sebacate (dms.)	lb.	1.30 -	1.30½
Dinonyl Adipate	lb.	.44½ -	.47
Dinopol IDO*	lb.	.29 -	.30½
MOP*	lb.	.30 -	.31½
Dioctyl Adipate (dms.)	lb.	.42½ -	.43½
Dioctyl Phthalate (dms.)	lb.	.28½ -	.30
Dioctyl Sebacate (dms.)	lb.	.61¼ -	.62¼
D.I.O.P. (dms.)	lb.	.28½ -	.30
Dipolymer Oil	gal.	.33 -	.48
Dispersing Oil No. 10*	lb.	.06 -	.06¼
Dutrex* 1, 6, 7	gal.	.18 -	.23
6H	gal.	.13 -	—
15E	gal.	.11 -	.23
20, 25	lb.	.03 -	.06
33	gal.	.21 -	.33
DX-111	lb.	.13¼ -	.14¾
DX-111 NS	lb.	.14¾ -	.15¾
DX-40	lb.	.14¾ -	.15¾
Elastex 10-P*	lb.	.30½ -	.33½
50-B*	lb.	.25 -	.28
DCHP*	lb.	.59 -	.60
Emulphor EL-719*	lb.	— -	.58
Epoxy Plasticizer	lb.	.33½ -	.36
Drapex 3.2*	lb.	.39¼ -	.40½
Drapex 4.4*	lb.	.34¾ -	.35¾
Drapex 7.7*	lb.	.37 -	.38
Esparto Wax	lb.	— -	.55
Estac*	lb.	— -	.16
Facile Gum 4A*	lb.	.48 -	.50
Flexol B-400*	lb.	.29 -	.30
DOP*	lb.	.29 -	.30½
TOF*	lb.	.47 -	.48
3GH*	lb.	— -	.46¾
3GO*	lb.	— -	.55¾
4GO*	lb.	— -	.36½
426*	lb.	.28½ -	.30
Flexricin P-1*	lb.	.33½ -	.36½
P-4*	lb.	.30½ -	.33¼
P-6*	lb.	.37 -	.40
P-8*	lb.	.30¼ -	.33¼

PLASTICIZERS & SOFTENERS (Cont'd)

Fortex A* (dms.)	lb.	.12½ -	.14½
Fura-Tone NC-1008*	lb.	.28 -	.39
Galex W-100*	lb.	.15½ -	.19¾
Good-rite GP233*	lb.	.40 -	.43½
GP235*; GP236*	lb.	.40 -	.43½
GP261*	lb.	.28 -	.31½
GP265*	lb.	.28½ -	.32
GP266*	lb.	.29 -	.32½
GP-266-BPA*	lb.	.29 -	.32½
Hallco C-255-NS*	gal.	.27½ -	.29½
C-566*	lb.	.11 -	.13
Harflex 300* (dms.)	lb.	.60½ -	.61
325* (dms.)	lb.	.45 -	.45½
330* (dms.)	lb.	.46¼ -	.46¾
375* (dms.)	lb.	.76 -	.76½
HB20*	lb.	.17 -	.18½
HB40*	lb.	.21½ -	.23
Herron-H.T.*	gal.	.16 -	.27
Herron-Plas*	lb.	— -	.03¾
Herron-Wax*	lb.	.05¼ -	.06
No. 23*	lb.	.08¼ -	.08¾
No. 24*	lb.	.07¼ -	.07¾
HSC No. 13*	lb.	.25 -	.32
No. 39*	lb.	.22 -	.29
Indonex W-2*	gal.	.12 -	—
Isooctyl Decyl Phthalate (dms.)	lb.	.28 -	.29½
Kapsol*	lb.	.35 -	.35½
Kenflex A & N*	lb.	.19 -	.34
Kesscoflex BCL* (dms.)	lb.	— -	.37
BCO* (dms.)	lb.	— -	.33
BCP* (dms.)	lb.	— -	.36
BCS* (dms.)	lb.	— -	.32
BO* (dms.)	lb.	— -	.28¼
BS* (dms.)	lb.	— -	.27½
DBT* (dms.)	lb.	— -	.68
DIOA* (dms.)	lb.	— -	.43½
DOA* (dms.)	lb.	— -	.43½
MCO* (dms.)	lb.	— -	.35½
MCP* (dms.)	lb.	— -	.41
MCS* (dms.)	lb.	— -	.35
TRA* (dms.)	lb	— -	.40
KP 23*	lb.	.32½ -	.33½
90*	lb.	.42½ -	.44
140*	lb.	.48 -	.48½
201*	lb.	.46 -	.47½
260*	lb.	.36½ -	.38
Kremol 40*	gal.	.36 -	.46
50*	gal.	.39 -	.49
Kronisol* (dms.)	lb.	.37½ -	.38½
Kronitex AA* (dms.)	lb.	.35 -	.36
1, K-3, MX*	lb.	.35 -	.36
Lanolin, Tech. Anhydrous	lb.	— -	.26
Latex-Lube G.R.*	lb.	.19¼ -	.20
Lead Oleate	lb.	— -	.29¾
Lindol* (dms., t.c.)	lb.	— -	.32½
Locusol No. 1-6980*	lb.	.30 -	.34
2-Mercaptoethanol (dms.)	lb.	1.25 -	1.50
Methox*	lb.	.41½ -	.42½
Methyl Laurate	lb.	.25 -	.27
Methyl Oleate	lb.	— -	.20
Methyl Stearate (dms.)	lb.	— -	.30
Monoplex DOS*	lb.	.59½ -	.60½
DBS*	lb.	.65½ -	.66½
S-70*	lb.	.41 -	.42
S-71*	lb.	.46½ -	.47¼
Montan Wax, Crude	lb.	.21 -	.26
Flaked	lb.	.29 -	.29
Mortlex*	lb.	.32 -	.69½
Natac*	lb.	.1585 -	.1685
Nebony Resins* (dms.)	lb.	.04½ -	.05½
Neolene 210* (t.c.)	lb.	— -	.16
212* (t.c.)	lb.	— -	.14
220* (t.c.)	lb.	— -	.15
Nerium*	lb.	— -	.09
Nevillac Resins* (dms.)	lb.	.31 -	.85
Neville LX-880* (dms.)	lb.	.12 -	.13½
LX-685* (dms.)	lb.	.12 -	.17½
LX-782 (dms.)	lb.	.07½ -	.08½
LX-828* (dms.)	lb.	.11 -	.12½
LX-1000* (dms.)	lb.	.12 -	.13
Neville Resins* (dms.)	lb.	.07¼ -	.20
Nevindene Resins* (dms.)	lb.	.16½ -	.20
Nevinol* (dms.)	lb.	— -	.24
No. 480 Oil Proof Resin*	lb.	— -	.18
Ohopex Q10* (dms.)	lb.	.30 -	.31½
R9* (dms.)	lb.	.37¼ -	.37¾
OPD*	lb.	.29 -	.40
Ortho-Nitrobiphenyl	lb.	.13 -	.15
Ozokerite Wax, White and Yellow	lb.	.24 -	.31
Panaflex BN-1*	lb.	.18 -	.22¼
Panarez 3-210	lb.	.12½ -	.14
6-210	lb.	.12 -	.13½
12-210	lb.	.11½ -	.13
Paradene Resins (dms.)	lb.	.07¼ -	.08
No. 2 Flaked	lb.	.08 -	.08½
Para Flux* (dms.)	gal.	.22 -	.25
2016* (dms.)	gal.	.22 -	.26
Para Lube* (t.c.l.)	lb.	.046 -	.048
Paraplex G-25*	lb.	.76 -	.77
G-40*	lb.	.50 -	.51
G-50*	lb.	.40¾ -	.41¾
G-53*	lb.	.15 -	.16
G-60* (and G-61*)	lb.	.32¼ -	.32¼
G-62*	lb.	.33¾ -	.33¾
Parmo*	lb.	.06 -	.13½
Peroxidol 780*	lb.	.33½ -	.36¼
781*	lb.	.34¼ -	.37¾
Petroflux MV*	gal.	.097 -	.127
Petrolatum (dms.)	lb.	.04¼ -	.14½

PLASTICIZERS & SOFTENERS (Cont'd)

PG-16*	lb.	——	.35
Philrich-5* (t.c.)	gal.	——	.12½
Picco 10* (and 25*)	lb.	.15	.15½
60* (and 75*)	lb.	.14½	.15
100*	lb.	.14½	.17
Piccocizer 30*	lb.	.06½	.07
Piccolastic A* (B*, C*, D* & E*)	lb.	.24	.25
FT* (FHX* & FX*)	lb.	.1695	.1745
T-135*	lb.	.19	.20
Piccolyte S Resins*	lb.	.20½	.23½
Piccopale Resins*	lb.	.12	.13
Piccoumaron Resins*	lb.	.07	.18
Pigmentar* Pigmentaroil*	lb.	.510	.684
Pitt-Consol 500* (dms.)	lb.	.30	.30½
Plastac M*	lb.	——	.09¼
Plasticil	lb.	.10½	.11¾
NS	lb.	.11½	.12¾
Plasticizer 2286*	lb.	——	.26¼
Plasticizer 4141*	lb.	.42½	.43½
Plasticizer DP-200, DP-250, DP-520*	lb.	.45	.45¾
DP-316*	lb.	.32¾	.33½
DP-317*	lb.	.46	.47¼
DP-8732*	lb.	.44¾	.46
Plasticizer LP*	lb.	——	.07
Plasticizer MP*	lb.	——	.08
Plasticizer MT-511*	lb.	——	.69¼
Plasticizer OLN*	lb.	.36	.42
Plasticizer SC*	lb.	.42	.46
Plasticizer W-13*	lb.	.37	.38¾
Plastoflex 3*	lb.	——	.52
52*	lb.	.37¾	.3o¾
VS*	lb.	.41¾	.42¾
Plastogen*	lb.	.08¾	.09
Plastolein 9050* (c.l.)	lb.	.54½	.56½
9055*	lb.	.30½	.32½
9058*	lb.	.48	.50
9250*	lb.	.38¼	.40¼
9715*	lb.	.39	.40
Plastone	lb.	.23	.27
Polycizer 162*	lb.	.27½	.29
332*	lb.	.42½	.44
562*	lb.	.28	.29½
662*	lb.	.28½	.30
532 and 632*	lb.	.42½	.44
ED*	lb.	——	.45
Polyco 438*	lb.	.34	.35
Polymel C-130*	lb.	.13¾	.14¾
D*	lb.	.22½	.23½
6*	lb.	.05¾	.07¾
Poly-Sperse AP-2	lb.	.23	.29½
AP-300, LC-20	lb.	.26	.32½
Poly-Sperse R-100	lb.	.17	.23½
Process Oil C-255* (c.l.)	gal.	.27½	.29½
Propylene Stearate (dms.)	lb.	——	.32
PRR 1*	gal.	.15	.35
PT 101 Pine Tar Oil* (t.c., dms.)	lb.	.0380	.0554
400 Pine Tar* (600* & 800*) (t.c., dms.)	lb.	.0380	.0554
PX-5	lb.	.21½	.22½
PX-7	lb.	.24	.25
PX-104* (dms.)	lb.	.31	.32½
PX-108* (dms.)	lb.	.28½	.30
PX-138* (dms.)	lb.	.27½	.29
PX-208* & 238* (dms.)	lb.	.42½	.43½
PX-404* (dms.)	lb.	.67½	.68½
PX-438* (dms.)	lb.	.61¼	.62¼
PX-800* (dms.)	lb.	.35¼	.36¼
PX-917* (dms.)	lb.	.35	.36
RC Plasticizer B-17* (dms.)	lb.	.23½	.24½
O-16* (dms.)	lb.	.30	.31
TG-8*&TG-9* (dms.)	lb.	.34½	.35½
TG-85* (dms.)	lb.	.36½	.37½
RC Polymeric BGA* (dms.)	lb.	.45½	.46½
Reogen*	lb.	.14¼	.14½
Resin C*	lb.	.0225	.0310
731D	lb.	.17½	.18½
Resinex*	lb.	.03¾	.05½
L-4*	lb.	.02¼	.04¼
Rexflex*	lb.	——	.15
Rosin Oil	gal.	.80	1.35
RR-10 (Neoprene)*	lb.	——	.37
R.S.O. Softening Oil*	lb.	.03	.05
RuBars*	lb.	.19¼	.20
Rubberol*	lb.	.18	.25¾
Santicizer B-16*	lb.	.46¾	.47¼
E-15*	lb.	.53	.54
M-17*	lb.	.44	.45
No. 140*	lb.	.35	.36
No. 141*	lb.	.36½	.37½
No. 160*	lb.	.27½	.29
No. 602*	lb.	——	.28½
No. 603*	lb.	.27	——
Sherolatum*	lb.	.03½	.06
Staflex DBES*	lb.	.58½	.61½
DOS*	lb.	.59¼	.62¼
IXA*	lb.	.32	.35
KA*	lb.	.34	.36¾
Stan Chlor Oils*	lb.	.13½	.20½
70*	lb.	.17½	.30
Stanolind Petrolatum*	lb.	.07	.156
Wax*	lb.	.31	.33
Staybelite Resin	lb.	.13¾	.15
Sunny South Burgundy Pitch*	lb.	.123	.1285
Rosin Oil*	gal.	.605	.76
Superla Wax*	lb.	.30	.397
Syncera Wax*	lb.	.16	.267
Syn Tac* (c.l.)	gal.	——	.33
Synthetic Revertant Oil	lb.	——	.16
Tar, Refined	gal.	.1200	.1760
Tarpine	lb.	.035	.050

PLASTICIZERS & SOFTENERS (Cont'd)

Terpene A*	gal.	——	.65
Tetraflex R-122*	lb.	.27	.30½
TP-90B*	lb.	.59	.69
TP-95*	lb.	.65	.75
Transphalt Resins*	lb.	.03¾	.05¾
Tributyl Phosphate	lb.	.52½	.53½
Tricresyl Phosphate	lb.	.35	.36
Triphenyl Phosphate	lb.	.41½	.43½
Turgum S*	lb.	.1460	.1560
Turgum SB*	lb.	.09½	.10½
Turpol NC-1200*	lb.	.67	.70
NC-1300*	lb.	——	.50
Vistac No. 1*	gal.	1.00	1.21
P*	lb.	.18	.18½
Vopcolene 50*	lb.	——	.31
Witcizer 100*	lb.	.26	.27
200*	lb.	.22¼	.25¼
300*	lb.	.30	.33½
312*, 313*	lb.	.28	.31½
412*	lb.	.42½	.46

PROCESSING AIDS

Castor Oil, Blown (dms.)	lb.	.25½	.26½
Refined (dms.)	lb.	——	.18½
Castorwax*	lb.	.25	.31
Dutrex 7*	lb.	.12	.20
ELA*	lb.	——	.82
Foamnix*	lb.	.60	1.50
Hydrofol Glycerides 200*	lb.	.15½	.19¾
Kenflex N*	lb.	.19	.26
Maleic Anhydride	lb.	——	.27
Millrex*	lb.	——	.15
Nadic Anhydride	lb.	——	.75
Polycin*	lb.	——	.24½
R-B-H Resin 510*	lb.	.19	.26
530*	lb.	.25	.32
STAYB*	lb.	.25	.45
Thiomalic Acid	lb.	——	3.50
Webmix*	lb.	1.25	2.00
Zyrox*	lb.	.78	.88

PROTECTIVE & STABILIZING AGENTS

Acacia*	lb.	.12¾	.21
Alcogum*	lb.	.08½	.24
Alpha Protein	lb.	——	.23
Aroostoocrat*	lb.	——	.07½
Carob Bean Flour	lb.	——	.50
Casein	lb.	.22	.35
Emcol K-8300* (dms.)	lb.	.14	.18
Ethylene Diamine 68%	lb.	.44	.47
Gum Arabic	lb.	——	.23
Karaya Gum	lb.	——	.35
Locust Bean Gum	lb.	——	.50
Modicol VD*	lb.	.13⅜	.15⅞
Prosein*	lb.	——	.06
Stablex B*	lb.	.50	.95
K*	lb.	.27	.35

RECLAIMING AGENTS

Amalgamator Z-4*	lb.	.34	.35
Armeen C*	lb.	.46	.52
Mixed Crude*	lb.	.19	.25
T*	lb.	.32	.38
Blend No. 27 Oil	gal.	.35	.42
Burco RA*	lb	.05	.081
BWH-1*	gal.	.16	.17
C-6 Oil* (28* & 32*)	gal.	.33	.38
C-10 Oil*	gal.	.25	.30
C-33* (t.c.)	gal.	——	.21½
C-42* (t.c.)	gal.	——	.23
Caustic Soda—Flake 76% (c.l., dms.)	cwt.	——	5.20
Liquid 50% (t.c.)	cwt.	——	2.90
Solid 76% (c.l., dms.)	cwt.	——	4.80
Cresylic Acid (99-100%)	gal.	.85	1.39
D-4* (t.c.)	gal.	——	.27
E-5* (t.c.)	gal.	——	.25
Flake Calcium Chloride (77-80%)	ton	——	31.00
(94-97%)	ton	——	39.80
Gensol No. 6* (t.c.)	gal.	——	.42
Heavy Aromatic Naphtha	gal.	.13¼	.18½
LX-572 Reclaiming Oil*	gal.	.27	.32
LX-777 Reclaiming Oil*	gal.	.23	.33
Neo-Fat D-242*	lb.	.05½	.07¾
42-70*	lb.	.08¼	.10¼
No. 517 H.B. Oil*	gal.	.11½	.16½
535*	gal.	.22	.27
Nucom* (t.c.)	gal.	——	.42
Pitt-Consol 500 (dms.)	lb.	.30	.30½
640 (dms.)	lb.	.42	.42
PT 101 Pine Tar Oil* (t.c., dms.)	lb.	.0380	.0554
Q Oil* (t.c.)	gal.	——	.286
Reclaiming Oil 3186-G*	gal.	.26	.33
Reclaiming Reagent No. 1431*	lb.	.21	.25
R.P.A. No. 3*	lb.	——	.51
RR-10*	lb.	——	.37
Soda Ash (c.l., bags)	cwt.	——	1.85
Solvenol No. 1	gal.	.50	.67
No. 2	gal.	.41	.62
Solvent 534*	gal.	.20½	.26½
Solvent Oil 21*	gal.	.24	.29
C-42*	gal.	.23	.38
701 Oil*	gal.	.27	.29

REINFORCING AGENTS—CARBON BLACK

Channel, Hard Processing (HPC) (bags)

Dixiedensed (and S)*	lb.	.0775	.1550
Kosmobile (and S)*	lb.	.0775	.1550

REINFORCING AGENTS—CARBON BLACK (Cont'd)

Channel, Medium Processing (MPC) (bags)

Arrow MPC*	lb.	.0850	.1625
Continental A*	lb.	.0850	.1625
Dixiedensed HR (and S-66)	lb.	.0850	.1625
Kosmobile HM (and S-66)	lb.	.0850	.1625
Micronex Standard*	lb.	.0850	.1625
Spheron 6*	lb.	.0850	.1625
Texas M*	lb.	.0850	.1625
Witco No. 1*	lb.	.0850	.1625

Channel, Easy Processing (EPC) (bags)

Collocarb*	lb.	.0710	.1485
Continental AA*	lb.	.0850	.1625
Dixiedensed 77*	lb.	.0850	.1625
Kosmobile 77*	lb.	.0850	.1625
Micronex W-6*	lb.	.0850	.1625
Spheron 9*	lb.	.0850	.1625
Texas E*	lb.	.0850	.1625
Witco No. 12*	lb.	.0850	.1625
Wyex EPC*	lb.	.0850	.1625

Channel, Conductive (CC) (bags)

Continental R-40*	lb.	.2600	.3500
Dixie 5 Dustless*	lb.	.1350	.2200
Dixie Voltex*	lb.	.2600	.3500
Kosmink Dustless*	lb.	.1350	.2200
Kosmos Voltex	lb.	.2600	.3500
Texas MC-74-BD*	lb.	.2600	.3500
Voltex*	lb.	.2600	.3500

Conductive Furnace Black (CF) (bags)

Aromex CF*	lb.	.0875	.1550
Continex CF*	lb.	.1100	.1700
Dixie CF*	lb.	.0925	.1600
Kosmos CF*	lb.	.0925	.1600
Shawinigan Acetylene Black*	lb.	——	.1900
Vulcan C*	lb.	.1100	.1850

Extra-Conductive Furnace Black (ECF) (bags)

Vulcan XC-72 (pellets)*	lb.	.2500	.3400

Furnace, Fast Extruding (FEF) (bags)

Arovel FEF*	lb.	.0675	.1350
Continex FEF*	lb.	.0675	.1350
Dixie 50*	lb.	.0675	.1350
Kosmos 50*	lb.	.0675	.1350
Philblack A*	lb.	.0675	.1350
Statex M*	lb.	.0675	.1350
Sterling SO*	lb.	.0675	.1350

Furnace, Fine (FF) (bags)

Statex B*	lb.	.0725	.1400
Sterling 99*	lb.	.0725	.1400

Furnace, General Purpose (GPF) (bags)

Arogen GPF*	lb.	.0600	.1275
Continex GPF*	lb.	.0600	.1275
Dixie 35*	lb.	.0600	.1275
Kosmos 35*	lb.	.0600	.1275
Statex G*	lb.	.0600	.1275
Sterling V*	lb.	.0600	.1275
V (Non-Staining)	lb.	.0600	.1275

Furnace, High Abrasion (HAF) (bags)

Aromex HAF*	lb.	.0775	.1450
Continex HAF*	lb.	.0775	.1450
Dixie 60*	lb.	.0775	.1450
Kosmos 60*	lb.	.0775	.1450
Philblack O*	lb.	.0775	.1450
Statex R*	lb.	.0775	.1450
Vulcan 3*	lb.	.0775	.1450

Furnace, High Modulus (HMF) (bags)

Continex HMF*	lb.	.0625	.1300
Dixie 40*	lb.	.0625	.1300
Kosmos 40*	lb.	.0625	.1300
Modulex HMF*	lb.	.0625	.1300
Statex 93*	lb.	.0625	.1300
Sterling L* and LL*	lb.	.0625	.1300

Furnace, Semi-Reinforcing (SRF) (bags)

Continex SRF*	lb.	.0575	.1250
Dixie 20*	lb.	.0575	.1250
Essex SRF*	lb.	.0575	.1250
Furnex*	lb.	.0575	.1250
Gastex*	lb.	.0625	.1350
Kosmos 20*	lb.	.0575	.1250
Pelletex* and NS*	lb.	.0575	.1250
Regal*	lb.	.0575	.1250
Shawinigan Acetylene Black*	lb.	——	.1900
Sterling NS* and S*	lb.	.0575	.1250
R*	lb.	.0625	.1350

REINFORCING AGENTS—CARBON BLACK (Cont'd)

Furnace Super Abrasion (SAF) (bags)

Aromax SAF	lb.	.1150	-	.1825
Dixie 85	lb.	.1150	-	.1750
Kosmos 85	lb.	.1150	-	.1750
Philblack E*	lb.	.1150	-	.1900
Statex 160*	lb.	.1150	-	.1900
Vulcan 9*	lb.	.1150	-	.1900

Furnace, Super Abrasion, Intermediate (ISAF) (bags)

Aromex ISAF*	lb.	.0925	-	.1600
Continex ISAF*	lb.	.0925	-	.1600
Dixie 70*	lb.	.0925	-	.1600
Kosmos 70*	lb.	.0925	-	.1600
Philblack I*	lb.	.0925	-	.1600
Statex 125*	lb.	.0925	-	.1600
Vulcan 6*	lb.	.0925	-	.1600

Furnace, Super Conductive (SCF) (bags)

Conductex SC*	lb.	.1150	-	.1800
Vulcan SC*	lb.	.1800	-	.2550

Thermal, Fine (FT) (bags)

P-33 (c.l.)*	lb.	——	-	.0625
Sterling FT (c.l.)	lb.	——	-	.0625

Thermal, Medium (MT) (bags)

Shellblack*(†)	lb.	——	-	**.0250**
Sterling MT (c.l.)	lb.	——	-	.0450
MT Non-Staining (c.l.)*	lb.	——	-	.0550
Thermax (c.l.)*	lb.	——	-	.0450
Stainless (c.l.)	lb.	——	-	.0550

Specialty Blacks (Awaiting Classification)

Neotex 100*	lb.	.0775	-	.1450
Neotex 130*	lb.	.0925	-	.1600
Neotex 150*	lb.	.1150	-	.1900
Regal 300*	lb.	.0775	-	.1450
Regal 600*	lb.	.0925	-	.1600

REINFORCING AGENTS—SILICA

Cab-o-sil*	lb.	.66	-	1.25
D. C. Silica (pelletized)*	lb.	1.45	-	1.65
Hi-Sil 233*	lb.	.08¼	-	.09¾
X303*		.50	-	.60
Santocel*	**lb.**	**.62**	-	**.64**
Ultrasil VN-3*	lb.	.35	-	.65
Valron Estersil*	**lb.**	**2.00**	-	**2.25**

REINFORCING AGENTS—MISCELLANEOUS

Angelo Shellac*	lb.	.40	-	.50
Cato 2* (100 lb. bag)	lb.	17.00	-	——
Darex Copolymer No. 3*	**lb.**	**.47**	-	**.49**
43G*	**lb.**	**.39**	-	**.41**
Darex Copolymer Latex No. 3-L	lb.	.41½	-	.46
Durez 12687 (and 12707)*	lb.	.36½	-	.40
Durez 13355*	lb.	.27½	-	.31½
Dymerex Resin	lb.	.15¾	-	.17
Good-rite Resin 2007*	lb.	.36	-	.38
2057*	lb.	.30	-	.31
Hystron*	lb.	.39	-	.41
Kralac A-EP*	**lb.**	**.39**	-	**.41**
Lampblack	**lb.**	——	-	**.12**
Marbon 8000*	lb.	.36	-	.43
Marmix*	lb.	.35	-	.43
Mistron Vapor*	lb.	——	-	.03½
HGO-55*	lb.	——	-	.05
Pliolite Latex 150*	lb.	.35	-	.39
Pliolite Resin-Rubber Masterbatches*	lb.	.33	-	.57
Pliolite NR*	lb.	.93	-	.95
S6B*	lb.	.36	-	.43
Plio-Tuf G85C*	lb.	.52	-	.54
Polyco 220*	**lb.**	**.18¼**	-	**.19¼**
Poly-Phen 201-C; 218-C	lb.	.27½	-	.29
202-C		.36	-	.37½
Polypol S-70*	**lb.**	**.25**	-	**.26**

RETARDERS

Akron Benzoic Acid TBAO-2*	lb.	.41	-	.43
Dutch Boy Normasal*	**lb.**	——	-	**.46**
ESEN*	lb.	.39	-	.41
Good-rite Vultrol*	**lb.**	**.67**	-	**.70**
Harcopol 1183*	**lb.**	**.70**	-	**.74**
Retarder J*	lb.	.68	-	.70
PD*	lb.	.39	-	.41
W*	lb.	——	-	.46
Retardex*	**lb.**	**.46**	-	**.46**
TCM-25*	lb.	.60	-	.70
Wiltrol P	lb.	.37	-	.39

RUBBER SUBSTITUTES

Mineral Rubber

Byerlyte*	ton	55.00	-	62.00
Hard Hydrocarbon (dms.)*	**ton**	**53.00**	-	**60.00**
Herron Flake*	ton	——	-	45.00
Mineral Rubber, Solid	**ton**	**42.50**	-	**44.50**
M. R. No. 38*	ton	57.00	-	70.00

RUBBER SUBSTITUTES (Cont'd)

Vulcanized Vegetable Oils

Amberex*	**lb.**	**.29**	-	**.36**
Brown	lb.	.15	-	.24
Car-Bel-Lite*	lb.	.33½	-	.36
Neophax*	lb.	.17	-	.27
Car-Bel-Rex A and C*	lb.	——	-	.126
White	lb.	.15	-	.26
670 Brown	lb.	.14¼	-	.14¾

Miscellaneous Rubber Substitutes

Gilsowax B*	**lb.**	**.09**	-	**.11**
Resin No. 1098 (dms.)*	**lb.**	——	-	**.62**
No. 1198*	**lb.**	**.46¾**	-	**.49¾**
Tysonite*	lb.	.26	-	.26¾

SOLVENTS

Acetone (dlvd.)	lb.	.11	-	.12½
Amsco Lactol Spirits*				
(t.c.)	gal.	——	-	.20
Naphthol Spirits*	gal.	——	-	.19
Mineral Spirits*	gal.	——	-	.18
Rubber Solvent* (t.c.)	gal.	——	-	.19
Solv A* (t.c.)	gal.	——	-	.22
Solv A-80* (t.c.)	gal.	——	-	.23½
Solv B* (t.c)	gal.	——	-	.28
Solv B-90* (t.c.)	gal.	——	-	.31
Solv D* (t.c.)	**gal.**	——	-	**.30**
Solv E*	**gal.**	——	-	**.30**
Solv F*	**gal.**	——	-	**.30**
Solv F-80*	gal.	——	-	.32
Solv G*	gal.	——	-	.36
Special Naphtholite*				
(t.c.)	gal.	——	-	.19
Special Textile Spirits*	gal.	——	-	.20
Super Hi-Flash				
Naphtha*	gal.	——	-	.34
Super Naphtholite*	gal.	——	-	.19
Textile Spirits* (t.c.)	gal.	——	-	.20
Amyl Chlorides, Mixed				
(t.c.l.) (dms.)	lb.	——	-	.11
Benzol 90%	**gal.**	**.36**	-	**.40**
Butyl Acetate	lb.	.17	-	.18½
Butyl Alcohol	lb.	.17	-	.19½
Secondary (dlvd.)	lb.	.15	-	.16½
Tertiary (dlvd.)	lb.	.15	-	.16½
Carbon Bisulfide, Tech.	lb.	.07	-	.08½
Carbon Tetrachloride	lb.	.10¾	-	.14¼
Cosol 1*	**gal.**	**.37**	-	**.43**
2*	**gal.**	**.42**	-	**.48**
Cyclohexane	gal.	.77	-	110.00
85% (c.l.) (dms.)	gal.	——	-	.86
Cyclohexanone	lb.	.31	-	.34½
Diacetone, Pure (dlvd.)	lb.	.15½	-	.17
Dichlorethyl Ether (dms.)	lb.	.15½	-	.16½
Dichloropentanes (l.c.l.) (dms.)	lb.	——	-	.06
Dicom*	gal.	——	-	.55
Halowax Oil*	**lb.**	**.28**	-	**.41**
Heptanes* (t.c.)	gal.	——	-	.1609
Hexanes (t.c.)	gal.	——	-	.1584
Isobutyl Acetate	lb.	.15¼	-	.16¾
Isopropyl Alcohol, Ref. 99% (dlvd.)	gal.	.62	-	.72
Ether, Ref. (dlvd.)	lb.	.09½	-	.11
Mersol*	**gal.**	**.43**	-	**.79**
Mesityl Oxide (dlvd.)	lb.	.15	-	.16½
Methyl Acetone, Syn. (dms., dlvd.)	gal.	.66	-	.72
Methyl Chloride	lb.	——	-	.12¾
Methyl Ethyl Ketone	lb.	.15	-	.16½
Methyl Isobutyl Ketone (dlvd.)	lb.	.17	-	.18½
Methylene Chloride	lb.	——	-	.12½
N-5 Pentane Mix* (t.c.)	**gal.**	——	-	**.13½**
N-6 Hexanes* (t.c.)	**gal.**	——	-	**.14½**
N-7 Hexanes* (t.c.)	**gal.**	——	-	**.13½**
Nelio Dipentene	gal.	.41	-	.62
Penetrell*	gal.	.41	-	.42
Perchlorethylene	lb.	.11¾	-	.15¼
Petrolene* (t.c.)	**gal.**	——	-	**.14125**
Picolines, Alpha, Refined	**lb.**	**.43½**	-	**.44**
Mixed	lb.	.32½	-	.33
Proprietary Solvent (dms.)	gal.	.66	-	.77
Propyl Acetate (t.c., dlvd.)	lb.	——	-	.11¾
Alcohol (t.c., dlvd.)	lb.	——	-	.11
Pyridine, Refined	lb.	.69½	-	.70
Quinoline	lb.	.50¾	-	.51¼
Rubber Solvent (t.c.)	**gal.**	——	-	**.16**
Rubsol (t.c.)	**gal.**	——	-	**.12875**
Skellysolve B (Hexanes)* (t.c.)	gal.	——	-	.16
C (Heptanes)* (t.c.)	gal.	——	-	.16¼
R (Rubber Solvent)*	gal.	——	-	.1390
Solvent, Crude, Light	**gal.**	**.19**	-	**.28**
Solvesso 100* (t.c.)	gal.	.33	-	.35
150 (t.c.)	gal.	.33	-	——
Sunny South DD Dipentine*	gal.	.41	-	.62
Sunny South DD Pine Oil*	lb.	——	-	.15
Sunray*	**gal.**	.1140	-	.1600
Toluene (dms.)	**gal.**	——	-	**.38**
Toluol (t.c.)	gal.	.25	-	.25
Trichlorethane	lb.	——	-	.12¾
Trichlorethylene	lb.	.12	-	.16¾
Triglycol Dichloride	**lb.**	**.63**	-	**.64**
Union Thinner 1* (t.c.)	**gal.**	——	-	**.174**
5* (dms.)	gal.	——	-	.199
7* (t.c.)	gal.	——	-	.164
2-50 W Hi-Flash*	**gal.**	——	-	**.41**
Xylol (t.c.)	gal.	.29	-	.30

STABILIZING AGENTS (for Vinyl Resins)

Advastab BC-12*	lb.	.90	-	.95
BC-74*	lb.	.70	-	.75
BC-105*	lb.	.75	-	.80
CH-101*; CH-201*	lb.	.60	-	.65
E-82*	lb.	.90	-	.95
JCX*	lb.	.62	-	.67
L Paste*	lb.	.65	-	.70
SN*	lb.	.47	-	.52
T-10*	lb.	1.90	-	1.95
T-50-LT*	lb.	3.20	-	3.25
XBZ-155*	lb.	.69	-	.74
XC-143*	lb.	.90	-	.95
XE-98*	lb.	.53	-	.58
Amioca 50* 85* (bags)	lb.	11.11	-	11.26
Barca 10*	lb.	.65	-	.70
Barium Stearate	lb.	.41	-	.46
Basic Silicate White Lead	lb.	.16½	-	.17½
Cadmium Ricinoleate	**lb.**	——	-	**2.00**
Calcium Ricinoleate	**lb.**	——	-	**.55**
Dutch Boy DS-207*	**lb.**	——	-	**.54**
B*	lb.	——	-	.32½
Tribase*	lb.	——	-	.27½
Dythal*	**lb.**	——	-	**.39½**
Ferro 182* (dms.)	lb.	.70	-	.76
200* (dms.)	**lb.**	**1.33**	-	**1.43**
203* (dms.)	**lb.**	**.87**	-	**.91**
541* (dms.)	**lb.**	**.35½**	-	**.45½**
541A* (dms.)	lb.	.82	-	.86
700* (dms.)	**lb.**	**.48¾**	-	**.58¾**
900* (dms.)	**lb.**	**.90**	-	**.94**
903* (dms.)	**lb.**	**.60**	-	**.64**
909* (dms.)	**lb.**	**.91**	-	**.95**
920*	**lb.**	——	-	**.98**
931* (dms.)	**lb.**	**.75¾**	-	**.85¾**
993* (dms.)	lb.	.89	-	.99
1203* (dms.)	**lb.**	**1.30**	-	**1.40**
1206* (dms.)	**lb.**	**1.32**	-	**1.36**
1820* (dms.)	**lb.**	**.90**	-	**.94**
1825* (dms.)	**lb.**	**1.00**	-	**1.04**
1976*	**lb.**	**.47**	-	**.51**
Harshaw 1-V-3*	lb.	.43	-	.45
1-V-4*	lb.	.68	-	.70
1-V-7*	lb.	.70	-	.72
2-V-4*	lb.	.85	-	.87
2-V-8*	lb.	1.31	-	1.33
5-V-1*	lb.	.41	-	.43
6-V-1B*	lb.	——	-	.55
6-V-2*	lb.	——	-	.55
6-V-6*	lb.	——	-	.55
6V-10*	lb.	——	-	.55
7-V-2*	lb.	.93	-	.95
8-V-1*	lb.	.82	-	.84
8-V-100*	lb.	.82	-	.84
9-V-1*	lb.	.70	-	.72
12-V-5*	lb.	.73	-	.75
24-V-1*	lb.	1.10	-	1.12
128-V-5*	lb.	.86	-	.88
Istabelan No. 115 Liquid	lb.	.85	-	.95
No. 120 Liquid	lb.	.65	-	.75
Kosol* (50 lb. bags)	lb.	19.00	-	——
Lithium Stearate	lb.	.52	-	.57
Fluffy	lb.	.47½	-	.70
Standard	lb.	.52½	-	.75
Mark A*	lb.	2.80	-	3.15
C*	lb.	.81	-	.84
E*	lb.	.72	-	.75
GS*	lb.	.77	-	.80
LL*	lb.	.59	-	.62
KCB*	lb.	.59	-	.62
M*	lb.	.59	-	.62
PL*	lb.	.62	-	.65
TT*	lb.	.72	-	.75
WS*	lb.	.97	-	1.00
X*	lb.	2.50	-	2.75
XI*	lb.	.87	-	.90
XV*	lb.	.84	-	.87
XX*	lb.	.57	-	.60
33*; 34*; 35*	lb.	.97	-	1.00
Metasap 613-A*	**lb.**	——	-	**.69**
613-B*	**lb.**	——	-	**.84**
613-C*	**lb.**	——	-	**1.06**
621*	**lb.**	——	-	**.88**
624*	**lb.**	——	-	**.75**
633*	**lb.**	——	-	**.75**
635*	**lb.**	——	-	**.45**
Modicol N*	lb.	.42½	-	.44½
S*	lb.	.30⅞	-	.32⅛
Nonisol 100	lb.	.38	-	.43
Sodium Silicates 41°/1:3.2	cwt.	1.20	-	2.30
Stabilizer No. 52*	**lb.**	**1.90**	-	**2.00**
89X*	**lb.**	**.75**	-	**.80**
B-5*	**lb.**	——	-	**.70**
E6B*	**lb.**	——	-	**.95**
G-1*	**lb.**	**1.25**	-	**1.40**
HR*	**lb.**	**.85**	-	**.89**
L*	**lb.**	——	-	**.60**
OM-10*	**lb.**	——	-	**1.95**
Staflex OY*	**lb.**	**1.00**	-	**1.20**
QXMA*	**lb.**	——	-	**.70**
Stayrite 10*	**lb.**	**.36**	-	**.41**
P-10*	lb.	.43	-	.45
15*	lb.	.55	-	.57
20*	lb.	.41	-	.46
22*	lb.	1.00	-	1.13
25*	lb.	.35	-	.40
70*	lb.	.70	-	.72
71*	lb.	.90	-	.92
75*	lb.	.61	-	.63
76*	lb.	.53	-	.55
80*; 90*	lb.	.70	-	.72
95*	lb.	.70	-	.72
229*	lb.	.61	-	.63

STABILIZING AGENTS (Cont'd)

Vanstay A* (dms.)	lb.	.50 -	.53
AB* (dms.)	lb.	.46 -	.49
AC* (dms.)	lb.	.45 -	.48
CE* (dms.)	lb.	.44 -	.47
HT* (dms.)	lb.	.87 -	.90
HTA* (dms.)	lb.	.97 -	1.00
HTB* (dms.)	lb.	.70 -	.73
HTC* (dms.)	lb.	1.09 -	1.12
HTE* (dms.)	lb.	.80 -	.83
L* (dms.)	lb.	.32 -	.35
R* (dms.)	lb.	.67 -	.70
RR* (dms.)	lb.	.59 -	.62
RZ-25* (dms.)	lb.	.65 -	.69
S* (dms.)	lb.	.57 -	.60
SA* (dms.)	lb.	.81 -	.84
W* (dms.)	lb.	1.22 -	1.25
Z* (dms.)	lb.	.62 -	.65

STIFFENING AGENTS

Polyac*	lb.	— -	1.85
Processinfi Stiffener 710*	lb.	.88 -	.90
Solvitose HDF, H, C-S, T, and E*	lb.	.22 -	.25
Versatil Gum 8-E*	lb.	.15 -	.19

SUN CHECKING AGENTS

Allied AA-1144*	lb.	.23 -	.24
AA-1177*	lb.	.15½ -	.16½
Antisol*	lb.	— -	.23
Antisun* (Chipped)	lb.	.15½ -	.17½
(Slabbed)	lb.	.15 -	.17
Heliozone*	lb.	.31 -	.32
Microflake*	lb.	.20 -	.24
Nacconol NRSF*	lb.	.40½ -	.45
NBC*	lb.	— -	1.67
Ross Sunproofing Waxes*	lb.	— -	.15
Sunolite*	lb.	.16 -	.22
127*	lb.	.16½ -	.20½
154*	lb.	.23 -	.25
Sunproof*	lb.	.32 -	.33
Improved*	lb.	.25 -	.26
Super*	lb.	.41 -	.42
Jr.*	lb.	.22 -	.23
Tonox*	lb.	.54 -	.56

SURFACE ACTIVE AGENTS

Anhydrapent*	lb.	.56 -	.59
Anhydrol 6990*	lb.	.51 -	.56
6991*	lb.	.51 -	.56
Aquarex D*	lb.	— -	.81
G*	lb.	— -	.21
MDL*	lb.	— -	.33
ME*	lb.	— -	.82
NS*	lb.	— -	.60
SMO*	lb.	— -	.50
WAQ*	lb.	— -	.22
Emulphor EL-620*	lb.	— -	.40
EL-719*	lb.	— -	.58
ON-870*	lb.	— -	.55
Hyonics*	lb.	— -	.28¾
Igepal CA-630	lb.	— -	.26
CO-630; CO-730*	lb.	— -	.29
CO-850; CO-880*	lb.	— -	.29
Igepon CN-42*	lb.	— -	.25
T-33*	lb.	— -	.21
T-51*	lb.	— -	.13½
T-77*	lb.	— -	.49
Kessco 50201*	lb.	— -	.44½
50203*	lb.	— -	.44¼
18201*	lb.	— -	.32
18203*	lb.	— -	.35½
Lipal 9-N,* 11-0*	lb.	.28 -	.29
8-0,* 6-0*	lb.	.29 -	.30
25C,* 52C*	lb.	.34 -	.35
15T*	lb.	.23 -	.24
Nacconol NR (dlvd.)	lb.	.14½ -	.16
NRSF (dlvd.)	lb.	.40½ -	.45
Pluronic L62*	lb.	.33½ -	.39
L64*	lb.	.33½ -	.39
Sellogen Gel*	lb	— -	.12¾
Soybean Lecithin	lb	.13 -	.17
Synatol AV-60*	lb.	.28 -	.29

TACKIFIERS

Amalgamator Z-4*	lb.	.34 -	.35
Arceo 620-32B*	lb.	.20½ -	.21½
716-30*	lb.	.18½ -	.19½
1041-21*	lb.	.16½ -	.17½
Arceo A-2*	lb.	.18 -	.19
Bunaweld Polymer No. 780*	lb.	— -	.24
Galex* (dms.)	lb.	.17¼ -	.20
Indopol H-300*	gal.	1.00 -	1.22
Koresin*	lb.	1.13 -	1.15
Liquid Rubber Flux*	lb.	— -	.14
Nacconol NRSF* (dlvd.)	lb.	.40½ -	.45
Nilox Resin* (c.l.)	cwt.	— -	16.00
Nopco 2271*	lb.	.16¾ -	.18¾
Oil*	lb.	.29 -	.40
PR-162 Resin Emulsion	lb.	.82 -	—
Resin V	lb.	— -	.23½
Synthol* (dms.)	lb.	.26 -	.30¼
Vistac A*	lb.	.21½ -	.22¼
Vistanex LM Grades*	lb.	— -	.45
Zirex* (c.l.)	cwt.	— -	15.25
82 Resin Solid (dms.)	lb.	.13½ -	.14½
84 Resin Solid (dms.)	lb.	.13½ -	.14½

THICKENERS (For Latex)

Alcogum AN-6*	lb.	.06 -	.06½
AN-10*	lb.	.09 -	.10
AN-25*	lb.	— -	.31
PA-15*	lb.	.13½ -	.17½
PA-15-B*	lb.	.13½ -	.17½
Betanol* (dms.)	lb.	.70 -	.95
CM Starch* (100 lb. bags)	lb.	26.85 -	—
Gomme Labolene*	lb.	.45 -	.47
Good-rite K-702*	lb.	.28½ -	.37
K-704*	lb.	.21 -	.22
K-705*	lb.	.30 -	.39
K-707*	lb.	.18 -	.19
K-708*	lb.	.28 -	.37
K-710*	lb.	.15 -	.16
Hycryl A-1000* (t.l.)	lb.	.090 -	.100
A-2000* (t.l.)	lb.	.335 -	.360
Hydroseal 3* (50 lb. bags)	lb.	9.19 -	—
Melojel* (100 lb. bags)	lb.	6.71 -	—
Modicol VD*	lb.	.13⅜ -	.15⅞
VE*	lb.	.13⅞ -	.16⅜
Polyco 296 BT*	lb.	.15 -	.16
296-N*; 530*	lb.	.15 -	.16
Propylene Laurate (dms.)	lb	.57 -	.82
Sodium Silicate, 41°/1:3.2	cwt.	1.20 -	2.30
Solvitose Series*	lb.	.22 -	.25

VULCANIZING AGENTS

Peroxide

Di-cup	lb.	1.10 -	—
T	lb.	1.10 -	1.50
R	lb.	1.60 -	2.00
40C	lb.	.55 -	.75
UC XK-1960*	lb.	5.50 -	—

Selenium

Vandex*	lb.	— -	7.00
VA-7*	lb	— -	.50

Sulfur

Blackbirdd* (c.l.)	cwt.	— -	2.90
Cloud* (c.l.)	cwt.	— -	2.85
Crystex*	lb.	.19½ -	.23
Darex Dispersed Sulfur*	lb.	.14 -	16
Devil A* (c.l.)	cwt.	— -	2.45
Dispersed Sulfur	lb.	.14 -	.16
Insoluble Sulfur 60*	lb	12½ -	.13
Ko-Blend 1S*	lb.	— -	.39
Mist* (Wettable) (c.l.)	cwt.	— -	4.05
Spider* (c.l.)	cwt.	— -	2.85
Star* (c.l.)	cwt.	— -	4.90
Sulfasan R*	lb.	— -	1.55
Tire* (c.l.)	cwt.	— -	2.45
Tube* (c.l.)	cwt.	— -	4.90
Vultac 2*	lb.	.47 -	.74
3*	lb.	.51 -	.78

Tellurium

Telloy*	lb.	— -	4.00

WETTING AGENTS

Advawet No. 10*	lb.	— -	.17
No. 33*	lb.	— -	.48
Aerosol 18*	lb.	.37 -	.42
AY*	lb.	.75 -	.80
MA 80%*	lb.	.40 -	.45
OT 75% Aqueous*	lb.	.40 -	.45
OT 100%*	lb.	.75 -	.80
OT-B*	lb.	.65 -	.70

WETTING AGENTS (Cont'd)

Alrosol* (dms.)	lb.	.36 -	.40
Alrosperse*	lb.	— -	.18
Alrowet D 65*	lb.	.31 -	.34
Anhydrol 6990* 6991*	lb.	.51 -	.56
Armacs*	lb.	.28 -	.77
Arquads*	lb.	.42 -	.61
Emcol 5100* (dms.)	lb.	— -	.31
Energetic W-100	lb.	.28½ -	.35
Etho-Chemicals*	lb.	.26 -	.58
Ethomeen S/15*	lb.	.48 -	.50
T/15*	lb.	.46 -	.48
Hyonic PE-90*	lb.	.25 -	.27
PE-100*	lb.	.25 -	.27
Kessco E-122* (dms.)	lb.	— -	.45
18201*	lb.	— -	.32
Kreelon 4D* (dms.)	lb.	.13 -	.16
8G* (dms.)	lb.	.26 -	.28
Kyro EO* (dms.)	lb.	— -	.29¾
Modicol N*	lb.	.42½ -	.44½
S*	lb.	.30½ -	.32½
Nacconol A* (dlvd.)	lb.	— -	.52
NRSF* (dlvd.)	lb.	.40½ -	.45
SL* (dlvd.)	lb.	.084 -	.10
60S* (dlvd.)	lb.	.19 -	.225
Nekal WS-25	lb.	— -	.38
WS 99	lb.	— -	.95
Orvus AB Granules*	lb.	.16¼ -	.17¾
Parnol*	lb.	— -	.13½
Regal Beads	lb.	.12¾ -	.16¾
H. D. Beads	lb.	.12¾ -	.15¾
Santomerse No. 3 Paste*	lb.	.26 -	.30
Sorapon SF-23*	lb.	— -	.18
SF-78*	lb.	— -	.30
Sorbit P*	lb.	.29 -	.31
Soybean Lecithin	lb.	.13 -	.17
Stablex G*	lb.	.50 -	.90
Tergitol 4* (dms., dlvd.)	lb.	.36½ -	.37½
7* (dms., dlvd.)	lb.	.43½ -	.44½
O8* (dms., dlvd.)	lb.	.36½ -	.37½
P28* (dms., dlvd.)	lb.	.18½ -	.19
Trenamine W-30	lb.	— -	.15
Vultamol*	lb.	— -	.17½
Wetsit Conc.*	lb.	.35 -	.35

MISCELLANEOUS CHEMICALS

Aquesperse 30*	lb.	— -	.11
Chiplac Paint	gal.	1.15 -	5.00
Copper Inhibitor No. 50*	lb.	— -	1.20
D-Tac*	lb.	— -	.22
Elastopar	lb.	2.05 -	2.07
2-Ethyl Hexanol	lb.	.23¾ -	.24¼
Fura-Tone Resin 1226*	lb.	.41 -	.43
MODX*	lb.	.38 -	.40
Nacconates*	lb.	.75 -	4.50
Para Resins*	lb.	.04 -	.04½
Pigmented Filmite* (dlvd.)	lb.	.16¾ -	—
Resorcin, Tech.	lb.	.77½ -	.81½
Rio Resin*	lb.	.70 -	.72
Rongalite CX*	lb.	— -	.21½
Sherosopes*	lb.	.13½ -	.18¾
Sublac Resin PX-5*	lb.	.23½ -	.24½
Synpep*	lb.	.54 -	.60
Tysomite*	lb.	.30 -	.30½
Vanfre*	gal.	2.45 -	3.00
No. 3* & No. 4*	gal.	1.95 -	2.00

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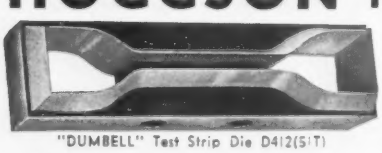
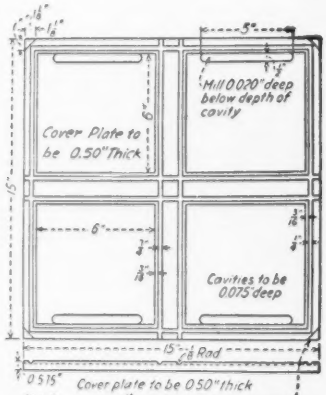
For Rubber Testing and Production



"DUMBELL" Test Strip Die D412(5IT)

For making tensile test samples, we make many types of slab molds. One is detailed at the right. These are plain or chrome finished. We usually stock molds for making adhesion, abrasion, flexing, compression and rebound test samples, but supply special molds promptly. We also furnish hand-forged tensile dies for cutting regular or tear test samples.

SLAB MOLD D15-55


Mill 0.020" deep below depth of cavity
Cover Plate to be 0.50" Thick
6"
Cavities to be 0.075 deep
15" Pad
0.515" Cover plate to be 0.50" thick
Mill four corners ½ deep for prying mold apart

HOGGSON & PETTIS MFG. CO., 141A Brewery St., New Haven 7, Conn.

Pac. Coast: H. M. Royal, Inc., Downey, Calif.

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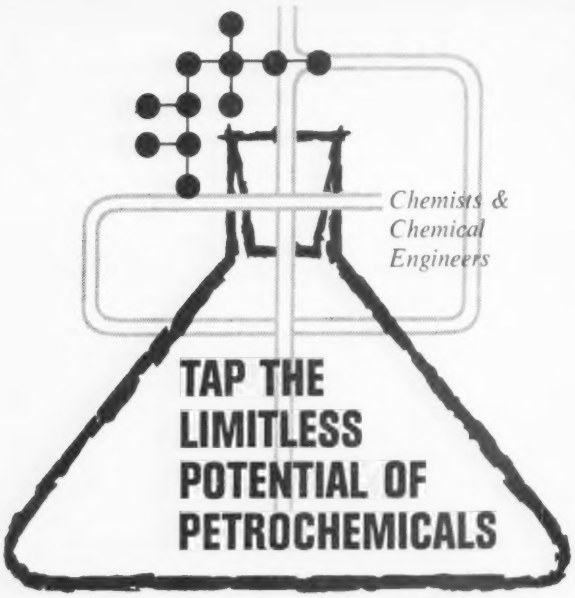

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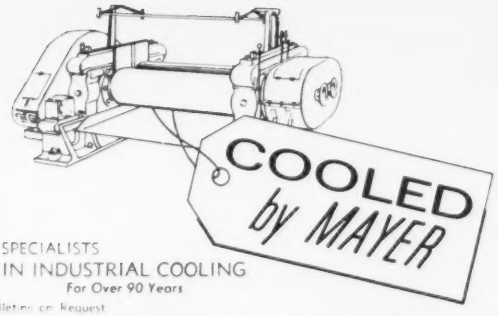

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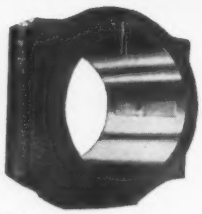

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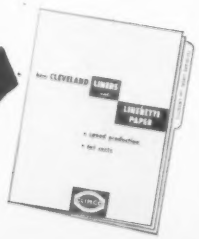

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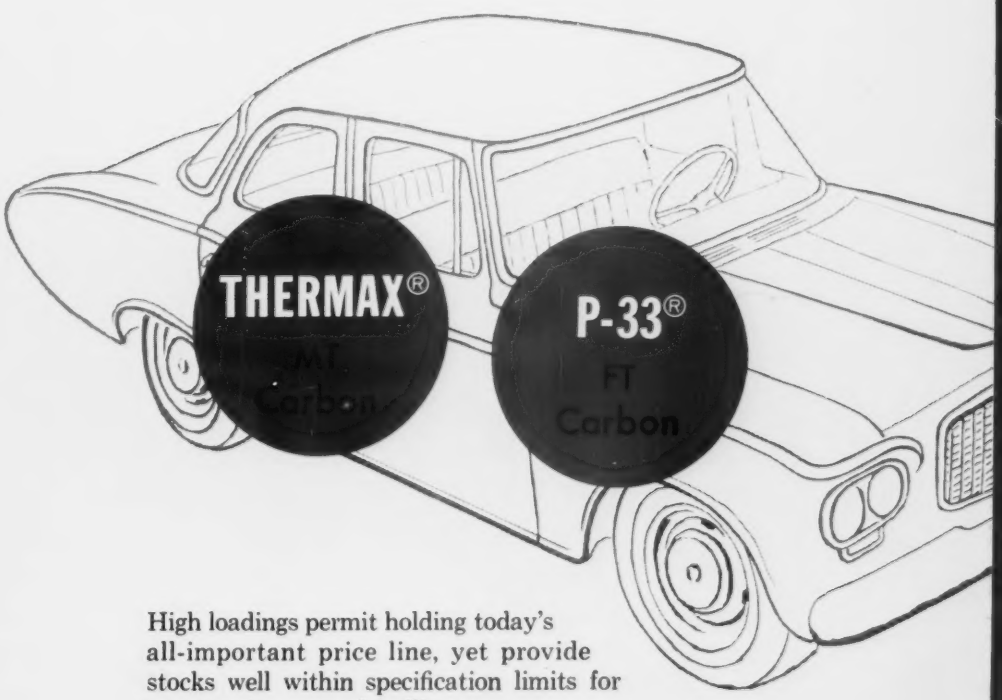

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